EKOTON, LLC
(License of the Ministry of Regional Development and Construction of Ukraine AB № 555532)

Customer: STEA «Lvov Railway»

General Designer: PJSC “DI “UKRSPETSTUNNELPROEKT”

«Beskyd Tunnel construction»

Project Review

Volume 13

26/11- 02/12 - OBOC

Environmental impact assessment (EIA)

Director L.I.Gronya

Chief Technician V.N. Kukharenko

Specialist I.B. Solukha

Kiev - 2012

Project brief

«Beskyd Tunnel construction»

volume №	Designation of the volume	Name of the volume	Notes
1	29/11-8511 - ИГ	Engineering geological and geophysical surveys	SE «Energoproekt»
2	26/11 - ПЗ	General explanatory note, drawings, specifications of works	
3	26/11 - ПОС	Project of constriction organization (PCO), explanatory note, drawings, specifications of works	
4	26/11 - ПГО	Mining allotment project	
5	26/11 - ТБ	Technical security	
6	26/11 - ПОГ	Project of the dump bank	
7	26/11-43/11- КС	Electric power supply. Contact network	PICE «Tehnotransproekt»
8	26/11-43/11-ПЖ	Railway	PICE «Tehnotransproekt»
9	26/11-43/11-СЦБ.СС	SIB devices. Signaling and communication units.	PICE «Tehnotransproekt»
10	26/11-43/11-АСУ	Automatic processing control system in the tunnel	PICE «Tehnotransproekt»
11	26/11 - АД	Automobile roads to the tunnel portals	
12	26/11 - ГЭМ	Project of the rock and ecological monitoring	
13	26/11- 02/12 - ОВОС	Assessment of the impact on the environment	Ekoton, LLC
14	26/11 - СМ	Cost estimating documents	

Approved by
Director EKOTON, LLC

L.I. Gronya

Adopted by
Chairman of the Board
PJSC "DI "UKRSPETSTUNNELPROEKT"

V.A. Volynskyi

EIA MATERIALS DEVELOPMENT TASK

Name of the object: «Beskyd Tunnel construction»

General Designer: PJSC "DI "UKRSPETSTUNNELPROEKT"

Construction type: new construction

Location: the construction site is located along the railway line connecting the railway station Lavochnoe on the north-east of the tunnel and the railway station Volovets on the south-west of the tunnel.

Design stage: project.

List of the sources of effect: construction and use of the tunnel, construction equipment and technological devices during the construction.

List of the possible negative influences: pollution agents during the construction, during the use – influence on the geological, water environment and noise.

List of the environment components being evaluated for the influences: atmospheric air, water and flora and others according to ГСН А.2.2-1-2003.

Requirements for the volume and stages of EIA: in the volume of ГСН А.2.2-1-2003 at one stage - "П".

Requirements for the participation of the public: familiarization through the mass media, consulting.

Order of holding and the terms of preparation of the EIA materials: the order of holding according to ГСН А.2.2-1-2003; the term – according to the Agreement.

To the task for the EIA materials development are attached: Application about the intentions, general layout and the situational scheme of the area of the planned activity, PCO materials, geological and engineering report, design materials.

APPLICATION about the intentions

APPROVED BY

(Local authority)

Seal

(position, name, patronymic, surname of the Director)

2012

1. Investor (Consumer)	STEA «Lvov Railway»
Postal address	Lvov, Gogolya Str., 1
2.Variants of the construction site location	The designing areas are situated along the railway line which connects the railway station Lavochnoe on the north-east of the tunnel and the railway station Volovets on the south-west of the tunnel
3. Construction type (object)	Beskyd Tunnel construction
(roughly under the objects-analogs, belonging to the objects of the increased ecological danger)	
Transboundary impacts are absent	
(existence of transboundary impact)	
Technical and technological data	Construction of the new double-track railway tunnel of the general length of 1764,5 m
(types and volumes of the products being produced, operation life)	
Operation life makes 30 years and more	
4. Social and economic necessity of the designed activity	
In order to improve the railway transportation between the East and the West Europe it is provided to build the new double-track tunnel located on the 5th Crete International Transport Corridor at the section of Beskyd-Skotarskoe.	
5. need of resources during the reconstruction, construction and operation	
According to the Appendix to the Order of the Cabinet of Ministers of Ukraine on 22.06.11 No. 582-p the land lots located outside the communities at the territory of Lvov and Zakarpatye Regions being transferred into the permanent use and rent with the change of their purpose to the State territory and trade association “Lvov railway” for the construction and arrangement of Beskyd Tunnel total – 6,19 he (of the forest) (with the change of its purpose to the lands of the railway transport), including: - Lvov Region, Skoliv District – 5,05 he for te account of the lands of Slavskoe subsidiary forestry enterprise “Galselles”: 0,28 he to the permanent use and 4,77 he - for the rent during the construction period; - Zakarpatye Region, Volovets District – 1, 14 he for the account of the lands of the State enterprise “Voloves Forestry” into the permanent use. The construction site of the East portal of the tunnel makes 29130 m^2; the construction site of the West portal of the tunnel is 2670 m^2.	
(the lands area being withdrawn for the temporary and permanent use, type of use)	
- of the raw materials	All constructions and materials from the plants-manufacturers are supplied by the railway to the construction site of the East portal of the tunnel where they are unloaded and stored. The solid-cast concrete and the mortar are prepared at the designed concrete-mixing assembly located at the construction site of the East portal of the tunnel. At the construction site of the West portal the building constructions, materials and equipment are supplied from the East portal using the designed automobile road.

	(types, volumes, place of excavation and drilling, sources)
-energy	(types, volumes, sources)
-- fuel – is absent	
-- electric power – for the electric power supply of the load being located at the construction site the complex transformer stations are assembled of КТПГС 10/0.4 с with the solidity-earthed neutral.	
-- warmth – autonomic electrical boiler-house	
- water	The water sources during the tunnel excavation are the engineering networks of the East and West construction sites. The water of the drinking quality is supplied.
(volumes, necessary quantity, water supply sources)	
- labour	construction according to the stuff listing
6. Transport supply (during the construction and operation)	
supply of the construction materials and the constructions by the automobile transport, need of the machines and mechanisms according to the calculation of the construction works	
7. Ecological and other limitations of the designed activity under the variants	
During the execution of the construction works the pollution of the air and the surface waters. The project will include the ecological, sanitary and hygienic, fire, town arrangement and territorial limitations according to the applicable regulations	
8. Necessary ecological and engineering preparation and protection of the territory under the variants	
The territory is terraced by the retaining walls. The arrangement of the waterproofing cover with the channeling of the ground waters.	
9. Possible impacts of the designed activity (during the construction and operation):	
- climate and microclimate	are absent
- air	within the possible limits
- water	the ground and industrial waters are disposed to the cleaning facilities located at the construction sited; during the tunnel excavation from the West portal by the natural flow; and from the East portal – using the pumps.
- soils	for the dump banks there are the specific zones: - at the West portal of the area of 2,1he; - at the East portal of the area of - 2,5he. The designed volume of the dump banks make: -at the East portal – 172,1 ths m^3 of the soils; -at the West portal – 42,8 ths m^3 of the soils.
- flora and fauna, wildlife territories	designed area is mainly covered with the forests with the molded surface, on the East slope by the pine-wood – fir and silver-fir, and on the West slope – by the leaf wood – beech. In the forests it is possible to find the small haylands and meadows. According to the Order of the Cabinet of Ministers of Ukraine on 22.06. № 582-p the land lots are transferred into the permanent use and rent with the change of the purpose to the State territory and trade association “Lvov railway” for the construction and arrangement of the Beskyd Tunnel of total – 6,19 he (woods), including;
- surrounding social environment (population)	positive, the improvement of the railway connection between the East and the West Europe
- surrounding technogenic	the project is made according to the applicable norms

environment	and rules, instructions and state standards and provides the measures securing the fire and blowing safety during the use of the object.
10. Industrial wastes, possibility of their secondary use, utilization, disinfection and safe burial	
utilization of the construction wastes and household wastes at the other territory according to the separate agreements with the specialized companies. The excavated ground is taken to the dump banks.	
11. The volume of EIA execution	according to the requirements of ГСН А.2.2-1-2003
12. People's participation	Lvov, Gogol Str., 1, tel. 8032226-44-00
(address, telephone and time of the examination of the materials of the project and EIA, the application of the offers)	
time of examination and application of the offers – 2012	

Customer

General Designer

APPLICATION about the ecological consequences of the activity during the use of the designed object

The designed activity – is the construction of the double-track Beskyd tunnel located on the 5th Crete International transport Corridor at the section of Beskyd-Skotarskoe. The new tunnel will substitute the existing old single-track tunnel built in 1886.

The purpose of the designed activity – is to improve the railway connection between the East and the West Europe, the execution of the "Program of the development of the national network of the international transport corridors for 2006 – 2010», adopted by the Order of the Cabinet of Ministers of Ukraine on 12.04.06 №496, Plan of the measures for the period up to 2010, the complex program of making Ukraine to be the transit country in 2002-2010 adopted by the Order of the Cabinet of Ministers of Ukraine on 01.08.07 № 606-p.

The way of achieving the goals – is the construction of the Beskyd Tunnel.

According to the Amendment to the Order of the cabinet of Ministers of Ukraine on 22.06.11 № 582-p the land lots located outside the communities at the territory of Lvov and Zakarpatye Regions being transferred into the permanent use and rent with the change of their purpose to the State territory and trade association "Lvov railway" for the construction and arrangement of the Beskyd tunnel of total - 6,19 he (wood) (with the change of its purpose into the lands of the railway transport), including:

- Lvov Region, Skolev District – 5,05 he for the account of the lands of Slavskoe subsidiary forestry enterprise "Galselles": 1,41 he for the permanent use and 3,64 he – for the rent during the construction;
- Zakarpatye Region, Volovets District – 1,14 he for the account of the lands of the state enterprise "Volovets forestry" for the permanent use. The construction site of the East portal makes 29130 m^2. The construction site of the West portal of the tunnel makes 2670 m^2.

Possibility of the emergency ecological situations

The project is designed according to the applicable norms and rules and provides the measures securing the fire and blowing safety during the use of the tunnel.

Existing factors of the influence on the fire-alarm system

During the construction:

- Break of the biosystems (biocenoses etc.), destruction of the green planting
- Temporary land withdrawal
- Industrial noise
- Pollution of the environment by the construction wastes
- Pollution by the emission of the nitrogen dioxide NO_2, carbon monoxide CO, hydrocarbons C_{12}-C_{19} and other polluting mixtures from the construction equipment, technological equipment
- Emergency emission of the cement dust and dust caused by the overload of the inert materials.
- Disposal of the waste waters with the weighted components (from the territory of the construction site and from the wells for the wheel washing) through the cleaning facilities and further with the flow after the purification into the existing steams in the area of the construction sites.
- Purification of the household waters at the cleaning facilities ЭКО-19.
- Hard household wastes during the construction are provided to be transferred according to the separate agreements.
- In case of execution of all designed decisions during the construction which are based on the applicable regulations and recommendations, the forecast of the possibility of appearance and development of the dangerous geological processes along the tunnel construction and the adjoining

territory, the development of the measures for their removal, the essential modifications in the hydrogeological situation of the construction territory are not expected.

- The use of the technologies and materials having the visible negative impact of the environment id forbidden.

During the operation

- Noise and vibration during electric train passing. All projected constructions getting to a zone of influence of the railway, are calculated on temporary loading from a rolling stock of SK. All designs for which influence of wheel loading both for a construction is possible and for operation – are calculated on the concentrated wheel loading of НК.
- For protection of the tunnel against ground waters and removal of hydrostatic pressure the closed waterproofing with dumping of drainage water in the underlining drainage is provided. Branch of an atmospheric precipitation and drainage waters from the upland party of retaining walls is carried out with use of system of monolithic reinforce-concrete drainage trays.
- For branch of streams and the river Vecha use of modular square reinforced-concrete pipes with water dumping in monolithic wells is provided. And also monolithic reinforced-concrete rapid flows and wells.
- Territory accomplishment.

Evaluation of the level of the ecological risk

The projected object is ecologically dangerous according to item 16 «Construction of the airports, railway junctions and stations, road service stations, river and seaports, railway main and automobile lines, undergrounds» additional Е to ГСН А.2.2 - 1-2003.

According to item 5.20 ГСН 176-93 «А housing estate it is necessary to separate from railway lines by the sanitary and protective zone with the width of 100 m from an axis of an extreme railway track under condition of providing standard noise levels in adjacent objects and in the building territory.

At railway placement in dredging and at implementation of special nose protection events the sizes of a sanitary and protective zone are established taking into account providing in the territory of a residential development of standard noise levels, but it is not less than 50 m. Thus not less than 50 % of the area of a sanitary and protective zone should be planted trees and shrubs.

Distance from borders of garden sites to an axis of an extreme railway track it is necessary to accept not less than 50 m at obligatory use of of the noise propective gardening in width of 25-30 m or other noise protective actions».

The projected object falls under sanitary classification enc. 9 ГСН 173-96 from standard С33 of 100 m.

Operation of object doesn't provide formation of harmful substances in atmospheric air. At the expense of optimization of design decisions at performance of nature protection actions and sanitary standards, the object practically won't carry out an adverse effect on environment.

The chosen land lot is suitable for construction of the Beskyd tunnel.

**** Noise influence on the population***

The Beskyd tunnel and site of design are placed along a railway line which connects the railway station Lavochnoe on the north-east of the tunnel and railway station Volovets on the south-west of the tunnel. Intermediate railway stations from each side of the Beskyd tunnel is a station of Beskyd on the north-east and station Skotarsky on the south-west of the tunnel. The occupied places aren't present, except several militarized posts of protection, military barracks and small constructions for railroad workers around priportalny sites of the tunnel.

On this site there is a single-line Beskyd railway tunnel, construction of the new double-track tunnel nearby is provided. The existing Beskyd tunnel will be maintained during all construction while the new tunnel won't be placed in operation, and should serve as the rescue tunnel during operation of the new tunnel.

According to calculations, in the preportal territory the expected noise level of L.A.equiv. day/night = 55,4/55,4 DBA at distance of 100 m (C33 border) that corresponds standard possible norms of equiv. day/night = 70/60 DBA.

** Impact of the ground waters*

At the above portal part of the ridge, on the east slope, the Oporets River, and on the west – the Vicha River originates. These small rivers consume generally atmospheric and flood waters, and also ground waters of the alluvial and delluvial water-bearing horizon.

Water supply

Water supply sources during the tunnel excavation are the engineering networks of the East and the West construction sites. Water of drinking quality is imported. The project provides system of fire-prevention water supply of the tunnel, a network and the constructions providing water supply on an internal firefighting in tunnels. Calculations of water supply are executed from a condition of the maximum water consumption when fire extinguishing.

Water disposal

For the disposal of existing streams on the East portal the project provides the closed system of pipes and wells. The extension of drainage pipes are accepted from the reinforced concrete blocks. Water is dumped in the existing well.

For collecting and assignment of an atmospheric precipitation from a front slope of the East portal the project provides the monolithic reinforced concrete tray with water dumping in the existing waterway. For collecting and water assignment from the tunnel and a underlining drainage on the West portal the project provides the closed system of pipes and wells.

Water is dumped in the closed part of the bed of the river Vecha which will be constructed for construction. For collecting and assignment of an atmospheric precipitation from a front slope of the West portal the project provides the monolithic reinforced concrete tray with water dumping in existing tunnel and further in the gutter located along projected railway.

The project provides the use of the clearing construction of the rain waters (5 units) of the Polish JPR SYSTEM **SWOK-100** form – the separator of oil products of productivity of 100 p/a with a settler.

Calculation of rain waters is executed in compliance to СНиП 2.04.03-85 items 2.11-2.18. Proceeding from a settlement consumption of rain waters the section of drainage trays is picked up. Settlement filling and speed in trays correspond СНиП. The section of water throughput pipes on the East and the West portals is accepted on the basis of the hydrological data according to the specification of the Customer.

Also the project provides the device of **treatment facilities of the economic and household sewerage ЭКО-19**. Installations are intended for purification of economic and household sewage of objects of all-economic appointment. ЭКО-19 has capacity (an expense of drains) of 19 m3/d., number of served conditional inhabitants – 125 people.

** Impact on the geological environment and soils*

According to the appendix to СНиП 1.02.07-87 “Engineering researches for construction” – the territory of researches belongs to 3 categories of complexity of engineering and geological conditions.

The body of the tunnel passes in radical breeds of krosnenska svita of a paleogene non-uniform on physicomechanical properties. At a tunnel driving on separate sites can be met both the destroyed zones,

and sites with the increased durability of soil (sandstones). From dangerous geological processes which can make negative impact on projected constructions, it should be noted the raised seismic ballnost of a site.

It is necessary to provide the following actions for protection of constructions:

- at insert of portals on a surface of slopes it is necessary to provide actions for an exception of shifts of integumentary loamy educations and block shifts of radical breeds at high cuts and dredging of soil. It is necessary to observe technology section of the cutting of the slopes, installation of the advancing and holding constructions against landslide provided with organized drainage and storm systems for interception of surface and underground water, arriving in borders of the territory mastered by construction. Carrying out geodetic and hydro-geological monitoring is recommended.

- at construction of portals and the tunnel in the massif of radical breeds of the most difficult there will be a driving: a) the thicknesses, the being characterized with the increased fracture, and the decreased durability; б) tectonic zones within which the thickness is strongly fractured, shattered, in separate places watered. For an exception of inrushes and collapses of breeds, in process of a driving, fastening of a roof and tunnel walls is recommended.

For the storage of the excavated ground the dump banks are provided with the specially provided zones:

- at the West portal according to the “Land development project of the land lots withdrawal to the state territory and trade association “Lvov railway” for the construction and arrangement of the Beskyd Tunnel outside the communities of the Skotarskoe village council of Volovets District of Zakarpatye Region”, with the area of - 2,1he, at the distance of 2000 m from the portal;

- at the East portal according to the “Land development project of the land lots withdrawal to the state territory and trade association “Lvov railway” for the construction and arrangement of the Beskyd Tunnel outside the communities of the Oporets village council of Skolivsk District of Lviv Region”, with the area of - 2,5 he, at the distance of 800 m from the portal.

For the transfer of the excavated ground the project provides the construction of the roads using the prefabricated reinforced concrete cover. The fill of the dump bank is made with the earth compaction with the layers up to 0,25m, during 16 steps, using the roller of 25t.

**** Impact on the flora***

The design site is generally covered with the wood, with the molded surface, on the east slope the coniferous – a fir-tree and a fir, and on the west slope deciduous – a beech. It is possible to find small haying grounds and meadows in the woods.

The project of land management of assignment of the land lots for construction of east portal of the tunnel with change of a designated purpose of STEA «Lvov railway» is coordinated by all interested parties according to Art. 149 of the Ground code of Ukraine with its following representation on approvals by the Cabinet of Ukraine (continuous using of the area of 1,14 hectares of the woods of the first group) and the Zakarpatye regional public administration (temporary rent for construction till the end of 2013 in the area of 2,1 hectares).

The project of land management of assignment of the land lots for construction of the west portal of the tunnel with change of a designated purpose of STEA «Lvov railway» is coordinated by all interested parties according to Art. 149 of the Ground code of Ukraine with its following representation on approvals by the Cabinet of Ukraine (continuous using in the area of 5,05 hectares of the woods of the first group, from them in continuous using – 1,41 hectares, in short-term rent for construction till the end of 2013 – 3,64 hectares) and the Lvov regional public administration (3,82 hectares of pastures, from them in a constant use of 0,56 hectares, in short-term rent on for construction till the end of 2013 - 3,26 hectares).

After the construction is finished it is provided to execute the plan of landscaping.

Safety estimates for population activity
Safety for population activity behind levels of chemical and noise influences is guaranteed at performance of the above-stated actions of protection.

Placement of projected object provides rational use of lands for performance «Programs of development of a national network of the international transport corridors for 2006-2010», approved by the resolution with the Office of the Minister of Ukraine from 12.04.06 of No. 496, the performance Plan of measures during the period till 2010. The comprehensive program of the statement of Ukraine as transit state in 2002-2010, the Cabinet of Ukraine approved by the order from 01.08.07 of No. of 606-R also has the minimum negative influence on environment.

ACTIONS which guarantee implementation
of the planned activity
according to environmental standards and norms

- The project is developed according to existing rules and norms and provides the actions providing the blowing and fire safety during the use of the tunnel.
- All designs for which influence of wheel loading both for a construction is possible and for operation – are calculated on the concentrated wheel loading of HK.
- The closed waterproofing with dumping of drainage water in the underlining drainage is provided. Branch of an atmospheric precipitation and drainage waters from the upland party of retaining walls is carried out with use of system of monolithic reinforced concrete drainage trays.
- For branch of streams and the river Vecha use of modular square reinforced concrete pipes with water dumping in monolithic wells is provided. And also monolithic reinforced concrete rapid flows and gutters.
- Recultivation and accomplishment of the territory of the construction site.
- The accomplishment and gardening of the nearby territory according to the dendrological plan.

List of the residual effects

- ✓ Noise and vibrations during the pass of the electric trains
- ✓ Drainage waters

Materials aimed to inform people about the designed activity

Informing of people is made through the mass media.
The advantages of people from the execution of the designed activity: the improvement of the railway connection, creation of the new working places.

LIABILITITES OF THE CONSUMER
concerning the implementation of design decisions
according to norms and rules of the environment protection and the requirements of the ecological safety

- at all stages of construction and operation of object of the planned activity
- the publication of the Statement for ecological consequences in mass media;
- construction and operation of object of projected activity according to norms and rules of the environmental protection and the requirements of the ecological safety;
- introduction of protective measures according to the above-stated list in EIA volume;

- export of the household wastes according to limits;
- territory gardening according to the gardening sheet.

Investor (Consumer)

General Designer

STRUCTURE and CONTENTS of EIA section

Application of the intentions (according to append. Г of ДБН А.2.2-1-2003)		
APPLICATION about the ecological consequences of the activity during the construction and operation of the designed object		
1	General characteristics of the object	
2	MATERIALS of EIA	
2.1	Requirements for the structure and the contents of the EIA section according to ДБН А.2.2-1-2003	
2.2	Basis for the execution of EIA	
2.3	Physical and geographical peculiarities of the region and the site of the location of the designed object	
2.4	Characteristics of the designed object	
2.5	General brief characteristic of the designed activity	
2.6	Situational schemes or the general layout with the impact sources	
2.7	Evaluation of the impact of the designed activity on the environment	
2.8	List of the components and objects (recipients) of the environment being the subject of the impact of the designed activity	
2.9	List of the components and objects of the environment in the non-normative condition	
2.10	Necessary and sufficient maps-schemes, tables etc.	
2.11	Climate and microclimate (К/Мк)	
2.12	MEASURES of prevention of the direct and indirect negative impacts of the designed activity on the climate/microclimate	
2.13	Chemical pollution of the air (А)	
2.14	Characteristics of the sources of the emission of the polluted components	
2.15	Physical pollution of the air	
2.16	Impact of the thermal pollutants, ultrasound, electromagnetic and ionization radiation	
2.17	Geological environment (GE)	
2.18	Water environment (WE)	
2.19	Impact of the designed activity of the condition of the GROUND WATERS	
2.20	Additional evaluation of the impact on the sea surface waters	
2.21	Impact of the designed activity on the condition of the UNDERGROUND WATERS	
2.22	MEASURES for the prevention and decrease of the impact of the WE	
2.23	Soils	
2.24	Vibration impact	
2.25	Flora and fauna, wildlife objects (WLO)	
2.26	Impact of the designed activity on the condition of the WLO	
2.27	Evaluation of the retrospective, existing and future condition of WLO according to the background and normative features	
2.28	Objects of the natural reserve fund (NRF)	
2.29	MEASURES for the protection of WLO	
2.30	Evaluation of the impact of the designed activity on the social environment (SE)	
2.31	Existing and future characteristics of the social and living environment of the local population ai the area of influence of the designed activity	
2.32	Evaluation of the positive and negative impacts of the designed activity on the social life conditions and satisfaction of needs of the local population	
2.33	Evaluation of the impact of the designed activity on the recreation zones	
2.34	Forecast of the impact of the designed industrial objects of I and II class of danger (under ГСП 173-96) on the health of the people	
2.35	MEASURES of the Society protection	
2.36	Evaluation of the impact of the designed activity on the surrounding technogenic environment (TE)	
2.37	Negative impacts of the objects of TE on the designed activity	
2.38	Complex measures for the secure of the normative condition of the environment and its safety	
2.39	Brief characteristics of the DESIGNED DECISIONS	
2.40	Results of the calculation for the specification of the economic efficiency of the execution of the environmental measures	
2.41	COMPLEX EVALUATION of the impact of the environment on the designed object	
2.42	COMPLEX EVALUATION of the impact of the designed object on the environment	
2.43	COMPLEX EVALUATION of the impact of the designed object on the environment if the designed measures are executed	
2.44	Specification of the ecological risk level of the designed activity and its impact of the human's living conditions	
2.45	Evaluation of the RISK OF CHANGE OF THE NATURAL, SOCIAL (SE) AND TECHNOGENIC (TE) ENVIRONMENTS	
2.46	Motivation of the adopted complex of the designed decisions according to the provision criteria	
2.47	Evaluation of the residual effects of the designed activity	
3	Evaluation of the impact on the environment during the construction (PCO section)	
3.0	Location and area of the construction sites, their characteristics	
3.1	MEASURES for the decrease of the impact of the reconstruction and construction on the environment	
3.2	COMPLEX ANALYSIS of the construction site condition	
3.3	COMPLEX ANALYSIS of the reconstruction and construction	
4.1	Evaluation of the impact on the environment during the LIQUIDATION of the designed object	
ADDITIONS		
Printout from the program "ЭОЛ"		
Copies of the Orders, letters, ТУ, dendrological plan		

1. GENERAL CHARACTERISTICS OF THE PROJECT

Planned activity – construction of the two-acceptable Beskyd tunnel located on the 5th Crete international transport corridor on a site of Beskyd – Skotarskoe. The new tunnel will replace the old existing single-line tunnel constructed in 1886.

The purpose of planned activity – improvement of railway traffic between Eastern and Western Europe, performance «Programs of development of a national network of the international transport corridors for 2006-2010», approved by the resolution the Office of the Minister of Ukraine from 12.04.06 of No. 496, the performance Plan of measures during the period till 2010. The comprehensive program of the statement of Ukraine as transit state in 2002-2010, the Cabinet of Ukraine approved by the order from 01.08.07 of No. of 606-river.

Ways of implementation of the purpose – Beskyd tunnel construction.

The purpose of EIA - is the determination of expediency of planned activity and justification of economic, technical, organizational, state and legal and other actions for the environment safety [1.1 ДБН А.2.2 - 1-2003].

Possibilities of the emergency ecological situations

The project is designed according to the applicable norms and rules and provides the measures securing the fire and blowing safety during the operation of the tunnel.

2 MATERIALS of EIA

2.1 Requirements of ДБН А.2.2-1-2003 to the EIA section

Table

Structure of te reported material of EIA (1.14 ГСН А.2.2-1-2003)	Fullness and accuracy
Following of the legal acts of the state authorities (Orders of the President, Decrees and Declaration of the Cabinet of Ministers of Ukraine and local executive authorities)	Completely followed
Following of the requirements of the applicable nature protection, sanitary and town-planning legislations	Completely followed
compliance to requirements of existing normative documents (ГСН, ВСН, РСН, state standards) regarding a regulation of the nature protection problems, use of natural resources, and also problems of providing safe conditions of activity of the population and operational reliability of technogenic objects	Completely correspond
not excess of influences on OS concerning indicators, standard and limited at the moment of object design (ГДК, limits, etc.)	Impact in the normal limits in case if the measures are executed
emergence in the environment of dangerous endogenny and ekzogenny geoprocesses and other phenomena (pollution, planting of reservoirs, shifts, a karst, settlement, flooding, flooding, an erosion, etc.)	Dangerous effects are not provided
observance of the ecological, sanitary-and-epidemiologic, technical and local functional планировочных restrictions	The limitations are followed
efficiency of the offered of the resourse storage, protective, renewable, compensatory and guarding measures	Efficiency of the measures in necessary and sufficient to secure the applicable norms

The settlement periods and starting complexes – construction is carried out in one turn: On the East portal of the tunnel creation of temporary construction site is provided.

2.2 Basis for the execution of EIA

Data about the documents being the basis for the execution of EIA as the part of the investment program or the construction project

Document	Date	№
KMU order «About approval of the location of the land lots»	11.03.09	263-р
The order of the Head of the Zakarpatye regional state administration «About coordination of materials of a choice of the location of the land lots of STEA «Lvov railway» for construction and arrangement of the Beskyd tunnel in the territory of Skotarsky village council of the Volovetsky area	19.05.09	230
The order of the Head of the Volovetsky regional state administration of the Zakarpatye area «About permission to design and construction of the object» the Volovetsky area	27.05.09	264
The order of the Head of the Volovetsky regional state administration of the Zakarpatye area «About the adoption of town-planning justification for the construction and arrangements of the new Beskyd tunnel»	16.10.08	394
Decision of Skotarsky village council of the Volovetsky region of the Zakarpatye area (the 18th session of the 5th convocation)	15.04.09	
The commission of the Zakarpatye regional public administration «About coordination of construction and arrangement of the Beskyd tunnel»	19.01.09	2469/06-21
Extraction from the minutes of the regional commission of the Volovetsky state administration on consideration of materials of coordination of placement of objects of construction	14.10.08	
Act of the acceptance and inspections of the land lot of page Skotarsky	8.07.08	
Design assignment on object: «Construction of the Beskyd tunnel», approved by the Chief engineer of STEA «Lvov railway»	15.07.11	
Architectural task (APZ). Object «Construction and arrangement of the new Beskyd tunnel on lands of Oporetsky village council of the Skolivsky area»	13.04.09	1
Architectural task (APZ). Object «the Beskyd tunnel between railway stations of Beskids and Skotarsky»	15.05.09	9
Technical conditions		
ТУ Alarm system and communication services on design of the western portal of the Beskyd tunnel.	07.05.09	Ш-8/338
ТУ separate division «Service of installation and construction works and civil constructions» on water consumption and water removal of construction and arrangement of the new Beskyd tunnel on its western portal in borders of the Zakarpatye area	28.04.09	БМЕСвод-18/туБсх
ТУ STEA «Lvov railway» separate division «Power supply service» on accession to electric networks of electroinstallations of legal entities and individuals	25.04.09	Е-1201/Е4-7
Management on questions supervising and preventive activity of GU Ministry of Emergency Situations of Ukraine in the Zakarpatye area	05.05.09	04/12/1336-Д
ТУ Territorial administration of state inspectorate for electrosavings on the Zakarpatye area	08.05.09	15-8-25-208
Conclusions for the project of the land management		
Zakarpatye Region		
Land user SE «Volovets forestry» (permanent use)	21.07.09	350
Skotarskoe village coucil (short-term rent during the construction 2013.)	21.07.09	23
Department of the Land Resources in Volovets District	30.07.09	01/01-03/1579
Department of regional development, town planning and architecture	21.07.09	667
Verchne-Latoritskyi section of the environment protection	04.08.09	813/08
District Sanitary Service	21.07.09	66/03
Mukachevo inter-district Administration of Melioration and water	23.07.09	107

management		
Regional production management on land improvement and water management	04.08.09	3/21-835
Chairman of Volovets District State Administration	30.07.09	1635/02-28
Regional management of the forest and hunting economy	04.08.09	02/08-1204
Regional culture administration	10.08.09	01-08/3389
Head department of protection of surrounding environment in the Zakarpatye area	18.09.09	2230/06/02
Order of Zakarpatye Regional State Administration	13.10.09	518
Lvov Region		
Land user Slavskoe SE «Galselles»	14.07.09	199
Oporets village council	17.07.09	139
Administration ofLand Resources of Sokolivsk District	14.08.09	28
Department of regional development of town planning and architecture	14.07.09	528
Skolivsk District Sanitary Service	16.07.09	
Skolivsk Distrcit State Administration	04.09.09	1210408-1748
Lvov Regional Administration of the forest and hunting management	28.07.09	1095/02
Lvov regional production management of a water management «Oblvodhoz»	28.07.09	09/1563
Regional management of protection of cultural inheritance	28.07.09	10/5018
State administration of protection of surrounding environment in the Lvov area	11.08.09	04-0204100
Head Department of the State Land Resources Department in Lvov Region	25.08.09	04-16/66
Order of the Lvov Regional State Administration		

Other documents if necessary are provided by the Consumer.

The list of sources of potential influence of planned activity on the environment taking into account its alternatives

The list of sources of potential influence of planned activity on the environment taking into account its alternatives: ***noise and vibration from pass of electric trains, drainage water***

The short characteristic of types of influences of planned activity on the environment and their list according to "Declaration of intent"

The ranged list of the main components of negative influence of projected object, where: L.A – noise level, DBA

Impact factor	Index		Units	State of matter
noise	equivalent level	L.A.equi.	dBA	vabrations
	maximum level	L.A.max		

List of ecological, sanitary-and-epidemiologic, fire-prevention and town-planning restrictions

Restrictions behind level of noise influence

According to item 8.37 ГСП 173-96 for sources which create continuous noise throughout more than 30 mines, equivalent level of a sound of L.A.equiv. is estimated, at smaller time of influence – a **maximum level of a sound of LA.max.**

For transport streams defining there are equivalent noise levels. Equivalent (on energy) level of a sound of L.A.equiv. DBA of this changeable noise - level of continuous broadband noise which has the same root-mean-square sound pressure throughout a certain interval of time [CH 3077-84].

Table

Standard maximum permissible equivalent SMPE.equiv. and maximum ПДУ.max. noise levels (DBA) for territories of a different functional purpose

Territory purpose, normative source	ГДР.day/night	
	equiv.	**max.**
Territories which adjoin to houses, medical and recreational institutions, boarding schools, child care, preschool and educational institutions [CH 3077-84; ДБН В. 2.4-1-94], to rest houses, boarding houses, libraries [ДСП 173-96], to selitebny zones of the occupied places [ДБН 360-92 **; СНиП II-12-77]	55 / 45	70 / 60
The amendment + 5 DBA for a housing estate which is reconstructed [ДБН 360-92 **] and for building which developed, except new buildings in it [CH 3077-84]	60 / 50	75 / 65
Zone of the I category of inhabited and public building [+10 - CH 3077-84; ДБН 360-92 **; additional 16 ДСП 173-96] in the conditions of reconstruction [+5 - CH 3077-84, ДБН 360-92 **]	70 / 60	85 / 75

Территория в 2 м от ограждающей конструкции здания	ГДК.день/ночь	
	экв.	мак.
Зона I эшелона жилой и общественной застройки	70 / 60	85 / 75

Noise SMPE in the rooms are established under condition of ensuring standard ventilation of premises, chambers, classes, that is, at open window leaves, transoms, narrow shutters of windows [to CH 3077-84. Sanitary standards of admissible noise in placements of residential and public buildings and on housing estate territories]. Therefore in the rooms, which not equipped driving ventilation considers window sound insulation with an open window leaf, a shutter or a transom.

SMPE L.A.экв.д и L.A.мак.д шума (дБА) для помещений

Territory purpose, normative source	ГДР.day/night	
	Equiv.	**Max.**
Inhabited apartments, recreational establishments, boarding schools [CH 3077-84; ДБН Б. 2.4-1-94]	40 / 30	55 / 45
Administrative building [ДБН Б.2.4-1-94]	50 / -	- / -

*** WATERS**

Pollution of a surface water by motor transport characterizes the content of the weighed substances (VV), oil products (N) and biological consumption of oxygen full (БПК.п).

Table

The ranged list of the main components of pollution of a surface water motor transport, where: C – concentration of substance, mg/dm3;

Impact factor	Index	Designation	Units	State of matter
- weighted substances	concentration	ВВ	mg/dm^3	- parts
- oil products		Н		- adds
- БПК.п		БПК.п	$mg.O_2/dm^3$	- mortar

* Permissible levels of the chemical pollution of the ground waters

Table

Limiting admissible maximum concentration limits (mg/l) of pollutants of water objects in points economic and drinking (хп), cultural and community (kb) and fishery (рх) water uses [additional 11 ГСП 173-96; item 16.11 ВБН В.2.3-218-007-98],

where: хп - the centralized or not centralized house-drinking water supply, and also water supply of the food enterprises; kb - bathing, sports and population rest, and also reservoirs within settlements (cultural and community water use); рх - fishery using; сф – background level of pollution of water object;

POLLUTANTS		ГДК.ГБ	ГДК.кб	ГДК.рх
Weighted components	ВВ	С.ф + 0,25	С.ф + 0,75	С.ф + 0,75
Emulsified oil products	Н	0,3	0,3	0,05
Biochemical oxygen consumption	БПК.п	3,0	6,0	3,0
Plumbum	Pb	0,03	0,03	0,01

The content of emulsified substances shouldn't increase more than on с.фон.гб + 0,25 mg/dm3 and с.фон.кб + 0.75 mg/dm3. For reservoirs which contain in the range of more than 30 mg/dm3 of natural mineral substances, the increase of emulsified substances in water within 5 % is allowed. With speed of loss more than 0,4 mm /s for flowing reservoirs and more than 0,2 mm / s for reservoirs with the flow are forbidden.

Relation of the public and other interested parties to planned activity and the connected unresolved problems

Informing of the population is carried out in mass media.

Benefits of the public from realization of planned activity: improvement of railway traffic between Eastern and Western Europe, performance «Programs of development of a national network of the international transport corridors for 2006-2010», approved by the resolution the Office of the Minister of Ukraine from 12.04.06 of No. 496, the performance Plan of measures during the period till 2010. The comprehensive program of the statement of Ukraine as transit state in 2002-2010, the Cabinet of Ukraine approved by the order from 01.08.07 of No. of 606-p, creation of additional workplaces.

The list and the short analysis of the previous coordination and examinations, including and public examination

The construction project of the two-acceptable Beskyd tunnel is developed on the basis of a design assignment on object: «Construction of the Beskyd tunnel», approved by the Chief engineer of STEA «Lvov railway» on 15.07.2011.

List of the used normative and methodological documents

ОНД-86. Методика расчета концентраций в атмосферном воздухе вредных веществ, содержащихся в выбросах предприятий. Л.: Гидрометеоиздат, 1987. - 92 с.

РД-238 УССР 84001-106-89. Установление допустимых выбросов вредных веществ в атмосферу предприятиями Минтранса УССР. К.: Минтранс УССР. 1989.

ДБН 360-92**. Містобудування. Планування і забудова міських і сільских поселень. Мінбудархітектура України. - К., 1993.

ДСП 173-96. Державні санітарні правила планування та забудови населених пунктів. Затв. Наказом Міністерства охорони здоров'я України від 19.06.96 № 173.

ДСП 201-97. Державні санітарні правила охорони атмосферного повітря населених місць (від забруднення хімічними і біологічними речовинами).

Методика расчета выбросов загрязняющих веществ и парниковых газов в воздух от транспортных средств. Наказ Госкомстат Украины №452 от 13.11.2008 р., 2008.

Солуха Б.В. Оцінка впливу об’єктів будівництва на навколишнє середовище (ОВНС) згідно ДБН А.2.2-1-95. К.: Знання України, 2000. – 112 с.

Солуха Б.В. Оцінка впливу шкідливих викидів автотранспорту на атмосферне повітря в зоні житлової забудови (згідно ДБН А.2.2-1-95). Методичні вказівки.. – К.: КНУБА, 2000. – 54 с.

ДБН А.2.2.1-2003. Склад і зміст матеріалів оцінки впливів на навколишнє середовище (ОВНС) при проектуванні і будівництві підприємств, будинків і споруд. Основні положення проектування.

Солуха Б.В., Фукс Г.Б. Міська екологія: Навчальний посібник. – К.: КНУБА, 2004. – 338 с.

СНиП II-12-77 (Р-2672). Защита от шума. НИИСФ. М.: Стройиздат, 1978. – 49 с.

Р-3126/626 НД-82. Руководство по расчету и проектированию средств защиты застройки от транспортного шума. НИИСФ. М.: Стройиздат, 1982. –28 с.

Справочник по защите от шума и вибрации жилых и общественных зданий. - К.: Будівельник, 1989. – 160 с.

Посібник до розроблення матеріалів ОВНС до ДБН А.2.2-1-2003. – Харків: УкрНДІІНТВ Держбуду України, 2002-04. Частина І - 156 с., частина ІІ - 220 с. [Посилка в тексті - Посібник УкрНДІІНТВ, 2002-04].

ГОСТ 17.1.1.01-77 (СТ СЭВ 3544-82). Охрана природы. Гидросфера. Использование и охрана вод. Основные термины и определения. - М.: Изд-во стандартов, 1977. – 13 с.

Водний кодекс України від 06.06.95 р. № 213/95-ВР із змінами та доповненнями від 21.09.00 р. № 1990-III, 07.12.00 р. № 21.20-III, 20.12.01 р. № 29.05-III.

Description of methods of forecasting of dynamics of indicators of HC and justification of the settlement periods of a forecast

Forecasting of ***chemical pollution of atmospheric air*** regarding determination of weight of emissions it is carried out according to methodical instructions «An assessment of influence of harmful emissions of motor transport on atmospheric air in a housing estate zone (according to ДБН А.2.2 - 1-95)» [КНУБА, 2000], a part II Grants to development of materials OVNS to ДБН А.2.2 - 1-2003 [Харьков: УкрНДІІНТВ Держбуду Украины, 2002-04] and monograph «City ecology» [Солуха, Фукс, 2004]. «The collection of indicators of issue (specific emissions) polluting substances in atmospheric air different productions». Volume 1,2,3 of developed UNTs of technical ecology. Donetsk-2004. RZA is carried out for OND-86 on "EOL" software.

Forecasting of ***noise pollution of atmospheric air*** is carried out according to СНиП II-12-77 (Р-2672 НДІ будфізики Держбуду), technique Р-3126/626 НД-82 SRI of the construction physics and SRI Golovmosbud with the comment of the international symposium [Osipov, etc., 1987], «To the directory on protection against noise and vibration of inhabited and public buildings» [1989].

Other influences aren't basic for adoption of design decisions.

Data on structural subsections of the performer and list of the subcontract organizations and experts who executed EIA

The organization which carried out EIA - EKOTON, LLC (the license for implementation of the section EIA AB No. 555532, phone: (044) 280-50-81).

The list of sources of information used at EIA

Materials of EIA were developed according to 1.13 ДБН А.2.2 - 1-2003 on the basis of engineering and ecological, sanitary-and-hygienic, technical surveys and researches on the basis of modern techniques and means. As basic data for performance of EIA the available share data characterizing a condition of the environment in the studied territory, monitoring data, results of technical and other researches of last years, cartographic materials and other available information served.

2.3 Physical and geographical peculiarities of the region and the construction site

Physical and geographical, land relief

The tunnel and project site geographically represent a part of East (Ukrainian) Carpathians. The Carpathians are a big semi-ring mountain ridge which was stretched between the Czech Republic, Poland, Slovakia, Ukraine and Romania.

The Beskyd tunnel and site of design are placed along a railway line which connects the railway Store station on the northeast party of the tunnel and railway station Volovets on the southwest party of the tunnel. Intermediate railway stations from each party of the Beskyd tunnel is a station of Beskids on the northeast party and station Skotarskoe on the southwest party of the tunnel. Heights on a site of the project are in a range from about 780 meters above sea level (at railway level) to at most 1014 meters above sea level. The territory of a site of the project a mountain, highest point – 1014 meters above sea level – is called High Tyn. The biggest heights in the territory of the project form a watershed going roughly from the northwest on the southeast. This watershed forms also border between two areas Lvov and Zakarpatye.

Natural slopes abrupt, in most cases a slope corner from 25 ° to 40 °.

In a overtunnel part of ridge, on east slope, the river Oporets, and on the western – the Vicha river originates. These small rivers eat generally atmospheric and flood waters, and also ground waters alluvial delluvial water-bearing horizon.

Seismicity of the area makes 8 points. Complexity of geological conditions – the III categories.

The design site is generally covered with the wood, with a molded surface, on east slope the coniferous – a fir-tree and a fir, and on the western slope deciduous – a beech. It is possible to find small haying grounds and meadows in the woods. The occupied places aren't present, except several militarized posts of protection, military barracks and small constructions for railroad workers around periportal sites of the tunnel.

Cartographic materials, situational schemes

Results of the analysis and assessment of changes of a condition of the environment components displayed on cartographic materials, situational schemes, the general plan and in the corresponding tabular materials (2.10 ГСН А.2.2 - 1-2003), are presented as a part of the project and in the EIA volume.

2.4. General characteristics of the designed object

Existence of positive aspects of realization of planned activity

- Positive ecological aspects of realization of object: the accomplishment and gardening of the nearby territory agrees with the dendrological plan.
- Positive sanitary-and-epidemiologic aspects: the projected activity meets the requirements of ГСН "Town planning. Planning and building of city and rural settlements" 360-92 ** also provides the environment protection.
- Positive social aspects of realization of object: improvement of railway traffic between Eastern and Western Europe, creation of additional workplaces.
- Positive economic aspects of realization of object: expected increases in receipts in the local budget from taxes.

2.5 General characteristics of the designing activities

General data

Beskyd Tunnel and the designed area are located along the railway line which connects the railway station Lavochnoe on the north-east part of the tunnel and the railway station Volovets on the south-west of the tunnel. The intermediate (small) railway stations on each side of the Beskyd Tunnel – are the station Beskyd on the north-east and the Skotarskoe station on the south-west of the tunnel.

In order to improve the railway service between the East and West Europe thought the existing Beskyd railway tunnel situated at the 5-th Crete international transport corridor at the area Beskyd-Skotarskoe it is provided to build a new double-track railway tunnel.

The new tunnel will replace the old existing single-track one built in 1886.

The existing Beskyd Tunnel will be used during the whole period of construction until the new tunnel is put into operation and further will be used as the emergency evacuation tunnel during the use of the new one. That's why it is very important during all the construction works to secure the structural unity and to influence as little as possible on the existing tunnel. This circumstance is taken into consideration by the corresponding sections of this project.

Architectural and natural conditions

In the administrative relation settles down on border of two areas: East portal – in the Lvov area, the Western portal – in the Zakarpatye area.

Heights on a site of the project are in a range from about 780 meters above sea level (at railway level) to at most 1014 meters above sea level. The territory of a site of the project a mountain, highest point – 1014 meters above sea level – is called High Tyn. The biggest heights in the territory of the project form a watershed going roughly from the northwest on the southeast. This watershed forms also border between two areas Lvov and Zakarpatye.

Natural slopes abrupt, in most cases a slope corner from 25 ° to 40 °.

In a nadtunnelny part of ridge, on east slope, the river Oporets, and on the western – the Vicha river originates. These small rivers eat generally atmospheric and flood waters, and also ground waters alluvial delluvial water-bearing horizon.

Seismicity of the area makes 8 points. Complexity of geological conditions – the III categories.

The design site is generally covered with the wood, with a molded surface, on east slope the coniferous – a fir-tree and a fir, and on the western slope deciduous – a beech. It is possible to find small haying grounds and meadows in the woods. The occupied places aren't present, except several militarized posts of protection, military barracks and small constructions for railroad workers around periportal sites of the tunnel.

General layout

Designed portal are situated near the existing ones over a distance necessary according to the requirements for the organization of works for their construction. Approaches to the East portal are limited from the North by the existing roadway, from the West – by the short slope and subsiding to the level of the designed railway. The extension of the periportal retaining walls near the East portal makes 73,8 meters. The height of the block wall is 13,6m.

On the part of the West portal there is a strongly marked topography with the height discontinuity at the construction zone up to 14 m. At the foot of the slope at the elevation of 786,00 m. there is a critical horizontal plateau adjoining the construction site.

The system of the retaining walls limiting the West portal consists of the block wall of 12,5m in length and 12,4m high and two variable wing walls following the relief. South aisle wall limits the slop of 150,4m in length. The total extension of the wall is 195,4m.

According to the engineering assignment of GTOO "Lvov Railways" the project provides the arrangement of the footpaths around the portals (and stairs at the sharp slopes). The guardhouse and the special purpose buildings are situated at the protected area. The fence and the warning sins are placed on perimeter.

Plan, profile, clearance of the tunnel

The section of the railway of 1764,5 m consists of the tunnel and two portal walls. The designed tunnel provides the double-track movement of the rolling equipment. The width between the track centerlines makes 4,10 m. The tunnel has the inner contour which corresponds the clearance diagram for the electrified railways under ГОСТ 9238-83.

The West portal is located in 15,8 m lower than the East portal herein the slope ratio of the tunnel makes from 3 to12 $^{0}/_{00}$

To evacuate people from the tunnel in case of the fire the three evacuation cross passages are provided from the designed tunnel to the existing one.

In the tunnel it is provided to construct the niches 2,0x1,0x2,0(h), being located mainly in 60 m from the both sides of the tunnel chequer-wise, and the chambers 4,0x2,5x2,8(h), being situated mainly each 288 m from the both sides chequer-wise. The total quantity of the niches 49 pieces, of the chambers -12 pieces.

General calculation principles. Seismically resistant measures.

Calculations for all supporting tunnel constructions, evacuation cross passages, portals and retaining walls, periportal buildings and constructions are made for the main and special (earthquake action) load combinations.

According to ДБН В.1.2-14-2009 "General provisions of the reliability and constructional security of the buildings, constructions, building structures and foundations", while calculating the supporting tunnel constructions and cross passages under the first limit state the importance factor γ_n=1,25 is taken as for the importance class CC3 and importance category A. For the rest designed buildings and constructions γ_n=1,05 is taken as for the importance class CC2 and the importance category B.

Calculations for the basic load combination are made on the basic of the first and the second limit states. The reliability factors of the materials are taken following the requirements of ДБН В.2.6-98:2009 «Concrete and reinforced-concrete constructions. General provisions». In the calculations on the basic of the second limit state the permissible width of the longstanding and short crack opening is specified as 0,2 and 0,3 mm respectively.

Calculations of the supporting constructions for the special load combination are made following the requirements ДБН В.1.1-12:2006 «Construction at the seismic areas of Ukraine», considering the seismic activity of the construction site of 8 points under MSK-64 scale. Calculations are made on the basic of the first limit state i.e. they suggest the permanent deformation after the calculated earthquake action, and the width of the crack opening in it is not specified. Herein the concrete interaction factor $m_{кр}$=1,2 is included following the requirements of ДБН В.1.1-12:2006 .

For all supporting elements of the constructions during the calculation the strength grade of the concrete on extrusion B25 (C20/25) is taken, working reinforcement of A400C grade.

Tunnel. Types of the permanent linings.

The double-track railway Beskyd tunnel is located in the plan on the line (see the drawing №26/11-12-1ТР «Tunnel pipelines»). The general length of the tunnel makes 1764,5 m (including the portal front walls δ=300 mm on the East and the West portals of the tunnel). The longitudinal slope is considered to be 3 and 12‰ (falling from the East to the West). The inner cross section of the linings provides the loction in its limits the clearance diagram C on the runs according to ГОСТ 9238-83 «Clearance diagrams of the constructions and the rolling equipment of the railways of the track 1520 (1524) mm» (see the drawing №26/11-14-1ТР «Clearance diagram»), equipment of the ventilation system, electric power supply system, sanitary system and the system of the signaling and communication systems (see the drawing №26/11-68-3СР «Inner lining of the tunnel. Location of the construction clearance in the tunnel linings»).

In order to optimize the drivages and to unitize the linings the external outline of all lining types is considered to be the same. The structure of the linings differs only by the percentage of the reinforcement specified according to the calculation results depending on the testing loads.

According to the geological report 24-8511-08,09,10-589, the tunnel along the whole pipeline crosses the following engineering and geological elements with the rock-hardness ration according to Protodyakonov: EGE-4a,5a (argillite and sandstone fractured) with f=3,0-4,0; EGE-4б,5б (argillite and sandstone highly fractured) with f=1,0-2,0; two fractured zones with f=1,0; at the periportal areas EGE-2a (clay loam with the layers of sand and crushed stone) with f=0,8.

According to the results of the calculations there are 4 types of the permanent lining:

- Type-I – portal area, constructed under the support of the piled retaining walls and the leading piperoof (at the tunnel insert);
- Type-II – at the periportal areas, the crown formation is impossible, provided for the full ground column EGE-2a, f=0,8, H=20 m (West portal) and for the full ground column EGE-4б f=1,0, H=16 m (East portal), and also at the transition point from the maximum rock pressure to the minimum (between the Type-III and Type-IV);
- Type-III – in the highly fractured rocks and specified fractured zones in the rock massif, provided for the crown formation for EGE-4б, f=1,0; at the West portal for the full ground column EGE-2a, f=0,8, H=25 m and for the possibility of the crown formation under EGE-2a (maximum reinforcement for this tunnel);
- Type-IV – in the fractured rocks, provided for the possibility of the crown formation for EGE-4a,5a, f=3,0. And at the periportal areas for the full ground column up to H=6m. Also the calculation checked the possibility to use the specified lining under the conditions for the crown formation for EGE-5б, f=2,0 (small sections along the tunnel).

For the linings located in the rocks EGE-4a,5a, f=3,0, but in the places of the joining to the evacuation cross passages, taking into account the possibility to increase the roof of the arch, and respectively the increase of the loads on the linings caused by the rock pressure the project provides more intense reinforcement than Type-IV (under Type-II). It is also provided the reinforcement of the entries in the tunnel lining (for the joining with the niches, chambers, cross passages) – by the bar frames in the lining body.

Location of the permanent lining types along the tunnel depending on the engineering and geological conditions see in the drawing №26/11-13-1ТР «Longitudinal section along the tunnel axis».

The main sizes of the reinforced concrete section of the permanent lining are – the arch δ=500 mm, walls δ=650 mm, invert δ=750 mm (see the drawing №26/11-65-3СР «Permanent tunnel lining. Cross sections Type-I…IV.»).

The inner contour of the temporary support is on 100 mm larger than the external contour of the permanent lining. The construction clearance δ=100 mm – is provided for the possible maturing of the temporary support inside the tunnel. The sections where the deformation of the temporary support is impossible are filled with the unreinforced concrete during the concreting of the permanent lining.

To protect the tunnel from the ground waters and to take the hydrostatic pressure off the project provides the closed waterproofing with the disposal of the drainage water in the underlining drainage. This construction represents the following:

- to the temporary support using the ground nails with the polyethylene gasket – rondel the geotextile δ=4 mm is fixed;
- to the gaskets-rondels by the welding the polyethylene geomembrane δ=2 mm is fixed;
- at the places of the cold concreting joints (between the invert and the walls of the tunnel and at the joints) to the polyethylene membrane are welded the polyethylene waterstops and in the body of the reinforced concrete section is fixed the swelling rubber strip which after the concreting interfere the leakage of the ground waters into the tunnel;
- at the places of the aseismic expansion joints similar the polyethylene waterstops are welded and in the body of the reinforced concrete of the joined sections of the tunnel the rubber waterstops are fixed to prevent the leakage of the ground waters into the tunnel and secure the compensational joint capacity;
- the ground water along the drainage layer of the geotextile is disposed into the underlining drainage (between the permanent lining and the temporary support);
- the underlining drainage represents the channeled perforated polyethylene pipes with the geotextile filter dusted with the crushed stone;
- the drainage water is disposed by the pipes with the slope equal to the fall of the tunnel from the East portal to the West, and at the West portal the water is disposed into the inlet wells.

To dispose the possible leakages of the ground water, return moisture, atmospheric precipitations (at the portal areas) and also the fire fighting water – inside the tunnel lining in the channel under the crushed stone ballast the project provides the assembly of the corrugated perforated polyethylene pipe with the geotextile filter. For the disposal of the water and the repair of the drainage system – along the tunnel with the step of 40 m the wells with the waste chamber are provided. Similar to the underlining drainage the water is disposed from the East to the West and at the West portal is disposed to the inlet well. The further disposal is provided in the section DSVWS.

Taking into consideration the absence of the strict recommendations about the fire resistance rating of the tunnel in СНиП II-44-78 «Railway and automobile tunnels», by analogy with СНиП 32-04-97 «Railway and automobile tunnels» (applicable at the territory of Russian Federation), and also according to the requirements of ДБН В.2.3-7-2003 «Transport constructions. Undergrounds» – the minimum fire resistance rating of the tunnel lining makes 1,5 hour. This fire resistance rating is secured by the protective layer of the concrete for the working reinforcement δ=60 mm. To avoid the fracture of the protected concrete layer – it is provided to fix in it the additional functional reinforced mesh. To protect the structure of the aseismic expansion joint from the fire at the inner side of the permanent lining of the tunnel it is provided to fill the joint by the non-burning mineral wool and the fire resistant joint filler..

Niches and chambers.

The project provides the construction of the niches and chambers located respectively each 60,0 m and 300,0 m chequer-wise at each side along the tunnel. Totally it is provided to construct 49 niches and 12 chambers. The minimum inner dimensions for the niches are: width – 2,0 m, height – 2,0 m, depth – 1,0 m. For the chambers: width – 4,0 m, height – 2,8 m, depth – 2,5m. The joining to the tunnel lining of the niches and chambers is provided through the cold concreting joint of the constructions. The thickness of the supporting elements on the reinforcement is specified according to the calculations for every type of the lining. The waterproofing is taken similar to the tunnel lining.

Evacuation cross passages.

For the passage of the maintenance staff and the possible evacuation of the people – between the designed and existing tunnels it is provided to construct the three evacuation cross passages. The planned location of the cross passages is specified according to the requirements of СНиП II-44-78 «Railway and automobile», and also taking into account the location of the chambers in the existing tunnel (in order to minimize the insert amount – the joining is provided at the area of the chambers location in the existing tunnel). The dimensions of the inner cross section of the cross passages and their longitudinal slopes are specified on the conditions of securing the requirements of the construction organization and the tunneling and completely provide the required dimensions of the evacuation routes. Taking into account the actual slope of the cross passage (unacceptable for the entrance ramp) the project provides the stair flights with the quarter paces and the ramp guide casing for the handicapped population group. Taking into consideration the fire resistance requirements of ДБН В.1.1.7–2002 «Fire safety of the construction sites» – the project provides the work of the cross passage as the tambour with the unit of the fire resistant screens and doors with the fire resistance rating R60 (EI60). The joining of the cross passages with the tunnels is the same as the joining of the tunnel with the niches and chambers. The thickness of the supporting elements and the reinforcement is specified according to the calculation (taking into account the possible increase of the roof of the arch at the joining area, for the ground EGE-4a). The waterproofing is taken similar to the tunnel lining.

Retaining walls, periportal buildings and constructions.

For the execution of the tunnel inserts, organization of the construction site for the period of the construction and the arrangement of the railways at the designed points during the exploiting period – at the East and the West portals of Beskyd tunnel it is provided to construct the retaining walls. The retaining walls represent the in-situ reinforced concrete piles Ø880 mm, joined in the space structure by means of the rigid fixing in the solid-cast reinforced concrete timbering. The step and the length of the piles, the quantity of the lines, the percentage of the reinforcement – are specified according to the calculation depending on the testing loads.

Also the piled retaining walls together with the shotcrete slope protection are provided to secure the automobile passage under the existing railways at the West portal.

To provide the railway passage above the automobile driveway at the West portal the project provides the use of the reinforced concrete prefabricated bars of the typical series 3.501-108 «Пролетные строения сборные железобетонные длиной от 2,95 до 16,5 м для железнодорожных мостов».

For the Vicha River diversion at the West portal above the timbering of the retaining wall it is provided to construct the runner (solid-cast reinforced concrete corridor). The solid-cast cushioning pool is provided to dispose the Vicha River at the lower points. This cushioning pool is also designed to dispose the drain water from the existing tunnel at the West portal (at the area where the tunnel crosses the retaining wall of the portal). To dispose the steams and to let the Vicha River flow under the railways it is provided the use the prefabricated square reinforced concrete pipes. To dispose the atmospheric precipitations and the drain waters from the uphill side of the retaining walls and from the construction site it is provided to have the system of the solid-cast reinforced concrete gutters with the water disposal into the solid-cast wells.

At the West and the East portals it is provided to have the solid-cast reinforced concrete guard houses. To secure the passage of the maintenance staff the project provides the solid-cast reinforced concrete stairs.

Water supply and water disposal.

The project provides the system of the tunnel fire-fighting water supply, networks and constructions providing the water supply for the inner firefighting in the tunnel. The calculations for the water supply are made on the conditions of the maximum water supply during the firefighting. The necessary pressures of the fire valves are calculated according to the requirements of СНиП 2.04.01-85, 2.04.02-84:

- efficiency of the fire flow 5 l/s;
- diameter of the fire valve Ø=65mm;
- diameter of the tip jet of the fire valve Ø=19mm;
- fire hose of L=20m, diameter Ø=65mm;

The height and the work range of the compact part of the fire flow we take according to the pos. 6.8 of СНиП 2.04.01-85 - 8m.

The discharge of water for the firefighting means is taken according to СНиП 2.04.01-85 table 2 and makes 10 l/s (2 flows per 5 l/s). Each point of the tunnel is watered by the two streams.

In the tunnels it is provided to lay the inner water-air firefighting water conduit. The fire posts are situated in the niches and the chambers with the step of 60 meters from the each side of the road bed. At the fire posts it is provided to locate the fire cabinets equipped according to ГОСТ 12.4.009-83 and НАПБ 03.004-2902. In the cabinets there are the fire valves Ø 65 mm with the hoses of not less than 20m length and the diameter of 65 mm, with the nozzles having the jet diameter of 19 mm and 2 portable fire extinguishers ОП-10 in each.

To secure the necessary pressure of the fire valves at the area of the tunnel portals it is provided to have the pump stations which are constructed for the period of construction and are joined by the pipelines with the fire basins.

To create the water storage for the firefighting in the tunnel the basins are used constructed during the construction process at the East and the West portals with the capacity of 2 x 100m3 f. The capacity of the basins is calculated on the condition of the firefighting during the 3hours using 10 liters per second. The maximum distance from the tunnel portals to the fire basins makes 30-50 meters. According to СНиП 2.04.02-84 pos.2.25 the period of the restore of the firefighting water volume in the fire basins makes 24 hours.

Taking into account the seismic conditions of the construction area the assembly of the main pipelines in the tunnel is made of the steel jointless hot-deformed tubes ГОСТ 8732-78 Ø 108×4mm, feed pipes of the fire valves are made of the pipes Ø 76×4 mm. For the external firefighting of the periportal areas near the portals the project provides the assembly of the fire hydrants. According to СНиП 2.04.02-84 pos.2.14, pos.2.15, table 7 the expense of the water per one fire makes 10 l/s.

Water disposal

To dispose the existing steams at the East portal the project provides the closed system of the tubes and wells. The extensions of the wastepipes are made using the reinforced concrete blocks of 1250x1500(h) and 2000x2000(h). The water is disposed into the existing waterway.

For the gathering and disposal of the atmospheric precipitations from the front slope of the East portal the project provides the solid-cast reinforced concrete invert with the section of 300x300(h) disposing the water into the existing waterway.

For the gathering and disposal of the water from the tunnel and from the underlining drainage at the West portal the project provides the closed system of the tubes and wells.

The water is disposed into the closed part of the Vicha River bed being made during the construction.

For the gathering and disposal of the atmospheric precipitations from the front slope of the West portal the project provides the solid-cast reinforced concrete invert with the section of 300x300(h) disposing the water into the existing tunnel and further into the gutter located along the designed railway.

The calculation of the rain waters is made according to СНиП 2.04.03-85 п.2.11-2.18. Taking into account the expense of the rain waters we picked the section of the gutters. The calculated filling and the velocity in the gutters follow the requirements of СНиП. The section of the conduit pipes at the East and the West portals is taken on the basic of the hydrological data according to the technical assignment of the Customer.

Electric power supply

The design documents for the constant electric power supply of the tunnel and the periportal constructions is made on the basic of the technical assignment for the design, technical requirements

№Л/0497-7 of Lvov railway, the assignments of the similar sections of the project, according to the applicable norms, standards and rules.

The project provides:

- the assembly and the connection of the two transformer substations with the capacity 2x250kWA and the voltage of 10/0,4 kW (West and East portals) ;
- connection of the distributing units of the tunnel (East and West portals) ;
- laying and connection of the dual cable lines to the electrical receivers of the tunnel and the near-tunnel constructions (West and East portals).

Sources of the electric power supply

According to the reliability factor the electric power supply of the tunnel and the near-tunnel constructions-consumers belong to the I and II category of the reliability according to ПУЭ 1.2.17.

Their electric power supply is executed using two designed transformer substations with the capacity of 2x250 kWA and the voltage of 10/0,4 kW, located at the East and the West portals of the tunnel.

Consumers of the electric power

The consumers of the electric power supply of the tunnels are:

- Electric lighting of the tunnel;
- Loads of the repairing mechanisms of the tunnel;
- APCS units of the tunnel;
- Ventilation of the passages of the tunnel;
- The object of the militarized guard (MG);
- Technological equipment of the railway

The project provides the use of the following voltages of the electric networks:

- For the power-operated consumers-380/220B;
- For the consumers of the automatics, lighting – 220W;
- For the luminaries of the local repair lighting – 12W.
-

Scheme of the electric power supply

The consumers of the electric power of the tunnel are powered from the customized control panels being located in the niches at the beginning of the West and the East portals. For the connection of the loads of the tunnel of the I-st category of reliability it is provided to assemble the cabinets with the automatic load transfer.

To connect the units of the low pressure (electric tools) each 120 m in the niches it is provided to assemble the boxes of ЯВШЗ type with the connectors for the current 63A.

To light the places of executing the works it is provided to fix in the niches the boxes with the step-down transformer 220/12W.

All assembled electric equipment is used in the moisture – and dust protected conditions of the category not lower than IP54, at the cable inputs of all devices, boxes, cases are fixed the pressure seals.

The power supply of the MG is executed from the control panels located in the guard houses. Herein the panels themselves are powered from the substations located at the East and the West portals of the tunnel.

The consumers of the technological equipment of the railway receive the power supply from the individual control panels which are powered directly from the designed substations.

Electric lighting

The project provides the working lighting of the tunnel, lighting of the niches, chambers, safety signs and the emergency lighting.

The electric lighting of the tunnel is made according to the requirements of the section 7 of СНиП II-44-78 «Railway and automobile tunnels». The average horizontal lighting in the tunnel at the clear floor level makes – 1lx.

The working lighting of the tunnel is made using the luminaries with the filament lamps. The luminaires are located on the both sides of the tunnel on the height of 3,2 m of the rail level with the step of 12 m. The lighting of the niches and chambers is made using the downlights with the filament lamps.

The emergency lighting of the tunnel (step of 12 m on the both sides), the light pointers of the evacuation routes «EXIT» and illumination of the fire valves are made by the photodiode luminaires with the integral accumulators and are powered from the boxes of the emergency lighting of the tunnel being situated in the niches at the beginning of the West and the East portals.

For the illumination of the safety signs and as the emergency lighting it is provided to use the luminaires with the integral accumulators.

Cable networks

The highway and the distributing networks in the tunnel are made using the cooper armored cables which do not spread the fire and do not set free the toxic agents.

For the power supply of the emergency lighting and the tunnel ventilation it is provided to use the fire resistant cable E-90.

The laying of the cables 0,4kW to the tunnel portal is provided to be executed in the trench and in the cable channels. In order to lay the cable networks of all voltages and functions at the both sides of the tunnel the project provides the assembly of the cable P2B11 with the step of 1 m, at the height of 1,1m from the rail level.

The protection of the cable lines with the voltage of 0,4 kW is made by the automatic switchers of the distribution substations.

Grounding

As the protection measures from the electrical shock caused by the damage of the isolation of the electric networks it is provided to use the protective grounding. The tunnel grounding system is joined with the grounding devices by means of the powered substations by the steel line of 40x4 mm.

The grounding of each cable bracket and luminaire bodies is made on the bonding backbone. The grounding of the separate consumers located in the tunnel is made by means of the zero protecting threads of the supply cables. At the transformer substation it is provided the assembly of the individual grounding.

Accounting

The energy accounting is provided at the low part of the transformer substations using the three-phase meters of the electronic type with the possibility to measure the active and the reactive energy with the category of accuracy not lower than 1,0, with the possibility to transfer the data by means of АСКУЭ.

Tunnel ventilation and smoke exhaust system

Ventilation system of the transport compartment.

The ventilation is made naturally by virtue of the difference of the atmospheric pressure at the portals and also thanks to the piston effect caused by the movement of the transport.

The absence of the necessity for the mechanical ventilation is supported by the calculations.

Smoke protection system of the evacuation routes

For the system of the smoke protection of the evacuation routes in case of the fire in the evacuation cross passages it is provided to assemble the ventilation units with the axial fans. The fans are reversible and fire resistant. The fire resistance rating is 2,5 hours with the temperature of 600ºC.

These units provide the following operation mode:

In case of the fire in the tunnel the axial fans are switched on. The direction of the air flows will be towards the tunnel being the area of the fire in order to avoid the smokiness of the evacuation routes and the neighboring single-track tunnel.

The signals for the activations of the fans are considered to be the achievement in the tunnel air the level of the carbon oxide (CO) – 20 mg/m^3; of the nitrogen oxides (NO) – 2,0 mg/m^3 .

In the tunnel the measurement transducers of CO, NO_2, smoke, temperature and moisture are fixed. The same measurement transducers are assembled also in the evacuation cross passages.

Improvement

The project provides the execution of the restoration of the land lots and the land improvement.

To avoid the destruction of the soils the project provides the protection of the slopes and the portals using the solid-cast concrete, the assembly of the retaining walls and the sowing of grass on the top of the backfilling. The project provides the sowing of grass ahead the backfilling above the tunnel periportal zones.

Measures to secure the fire safety during the use of the tunnel

The organization and technical measures preventing the fire in the tunnel during its use are considered to be the following:

- the development of the norms and rules of the fire safety, Instructions about the order of the use of the firefighting means and materials, about the following of the fire-resistant mode and the actions of the people in case of the fire;
- the production and the use of the visual propaganda for the secure of the fire safety;
- the development of the measures taken by the workers, passengers of the trains in case of the fire and the measures of the evacuation of the people;
- main types, quantity, location and the maintenance of the fire equipment;
- all evacuation routes must be marked according to the requirement of the fire safety;
- in the underground constructions of the railway tunnel it is forbidden to smoke at the unarranged area, to block the evacuation cross passages (passages, cross passages into the tunnel), accesses to the communication units and the firefighting equipment, and also to let the temporary storage at the specified areas of the different materials, equipment and tools, to amalgamate the exhaust oils into the drainage system. It is necessary to provide the free access of the fire trains and automobiles to the portals;
- the administration of the maintenance service must execute the quarter examination of the drainage system of the tunnel and not let the accumulation of the burning deposits in it.

The responsibility for the secure of the firefighting measures during the execution of the hot works is laid on the head of the operational section during the execution of the fire safety requirements.

Dimensions of the construction sites, the area of the used lands

According to addition to KMU Order from 22.06.11 of No. of 582-p the land lots located outside the limits of settlements in the territory of the Lvov and Zakarpatye areas, which are transferred in continuous using and rent with change of a designated purpose to the state territory and trade association «Lvov railway» for construction and Beskyd tunnel of all - 6,19 hectares (wood) (with change of a designated purpose of the woods with lands of railway transport), including:

- The Lvov area, the Skolevsky area - 5,05 hectares at the expense of lands of the Slavsky affiliated silvicultural enterprise "Galselles": 1,41 hectares in continuous using and 3,64 hectares – in rent for construction;

- The Zakarpatye area, the Volovetsky area – 1, 14 hectares at the expense of lands of the state enterprise «Volovets forestry» in continuous using.

The construction site of the East tunnel has the area of 29130 sq.m, the consruction site of the the West tunnel – 2670 m2.

Levels of danger of the designed objects and technologies

The projected object is ecologically dangerous according to item 16 «Construction of the airports, railway junctions and stations, road service stations, river and seaports, railway main and automobile lines, undergrounds» additional Е ГСН А.2.2 - 1-2003.

According to item 5.20 ГСН 176-93 «А housing estate it is necessary to separate from railway lines a sanitary and protective zone with the width of 100 m from an axis of an extreme railway track under condition of providing standard noise levels in adjacent objects and in the building territory.

At railway placement in dredging and at implementation of special noise protection events the sizes of a sanitary and protective zone are established taking into account providing in the territory of a residential development of standard noise levels, but it is not less than 50 m. Thus not less than 50 % of the area of a sanitary and protective zone should be planted trees and shrubs.

Distance from borders of garden sites to an axis of an extreme railway track it is necessary to accept not less than 50 m at obligatory use of the noise protection gardening in width of 25-30 m or other noise protection actions».

The projected object falls under sanitary classification enc. 9 ГСН 173-96 from ***standard С33 of 100 m***.

Operation of object doesn't provide formation of harmful substances in atmospheric air. ***At the expense of optimization of design decisions at performance of nature protection actions and sanitary standards, the object practically won't carry out an adverse effect on environment.***

The chosen land lot is suitable for construction of the Beskyd tunnel.

Raw material, water, energy and other used resources

The electric power is consumed from a network according to ТУ No. ЛІ/0497-7 of Lvov railway. Water of drinking quality is imported. The water supply sources during the tunnel excavation are the engineering networks of the East construction site. Near the portal it is provided to assemble the pump station in order to elevate the system pressure during the fire.

Warmth for the construction is supplied using the device electric boiler-house. A manpower at construction and operation according to the staffing table.

Description of the technological process of the designed activity

List of all factors of impact on the natural environment

During the objet construction

- Break of the biosystems (biocenoses etc.), the removal of the green planting
- Temporary land withdrawal
- Industrial noise
- Pollution of the environment by the construction waste
- Pollution by the emission of the nitrogen dioxide NO_2, carbon monoxide CO, hydrocarbons C_{12}-C_{19} and other polluting mixtures from the construction equipment, technological equipment
- Emergency emission of the cement dust and dust caused by the overload of the inert materials.
- Disposal of the waste waters with the weighted components (from the territory of the construction site and from the wells for the wheel washing) through the cleaning facilities and further with the flow after the purification into the existing steams in the area of the construction sites.
- Purification of the household waters at the cleaning facilities ЭКО-19.
- Hard household wastes during the construction are provided to be transferred according to the separate agreements.

- In case of execution of all designed decisions during the construction which are based on the applicable regulations and recommendations, the forecast of the possibility of appearance and development of the dangerous geological processes along the tunnel construction and the adjoining territory, the development of the measures for their removal, the essential modifications in the hydrogeological situation of the construction territory are not expected.
- The use of the technologies and materials having the visible negative impact of the environment id forbidden.

During the operation of the object

- Noise and vibration during electric train passing. All projected constructions getting to a zone of influence of the railway, are calculated on temporary loading from a rolling stock of SK. All designs for which influence of wheel loading both for a construction is possible and for operation – are calculated on the concentrated wheel loading of HK.
- For protection of the tunnel against ground waters and removal of hydrostatic pressure the closed waterproofing with dumping of drainage water in a underlining drainage is provided. Branch of an atmospheric precipitation and drainage waters from the upland party of retaining walls is carried out with use of system of monolithic reinforced concrete drainage trays.
- For branch of streams and the river Vicha use of modular square reinforced-concrete pipes with water dumping in monolithic wells is provided. And also monolithic reinforced-concrete rapid flows and gutters.
- Territory accomplishment.

The ranged list of the main components of negative influence of the projected object, where: L.A – noise level, DBA

Impact factor	Index	designation	Units	State of matter
noise	equivalent level	L.A.екв	dBA	vibrations
	maximum level	L.A.мак		

The list of the technical solutions directed on elimination or reduction harmful emissions, dumpings, sources of radiations in the environment

- All designs for which influence of wheel loading both for a construction is possible and for operation – are calculated on the concentrated wheel loading of HK.
- The accomplishment and gardening of the territory corresponds the dendrological plan.
-

Assessment of possibility and development of emergencies

The risk of emergency ecological situations (explosion and/or a fire) doesn't exceed typical for the occupied cities of Ukraine.

Fire safety of the projected object is provided with a way of observance of requirements of ГСН В.1.1-7-2002 “Protection against a fire. Fire safety of objects of construction” and others approved by current legislation, normative documents which regulate requirements of fire safety.

The territory will be well-planned.

Possible borders of a zone of influence

Borders of a zone of influence which is commensurable with standard, for construction and operation are limited to borders of the land lot.

2.6 Situational schemes or the master plan with influence sources

Results of the analysis and assessment of changes of a condition of the environment components are displayed on cartographic materials, situational schemes, the general plan and in the corresponding tabular materials (2.10 ГСН А.2.2 - 1-2003).

Scheme of location of the East tunnel construction site

2.7 Evaluation of influences of the designed activity on surrounding environment (SE)

In this volume of EIA those components and objects of SE are specified which influence the designed activity and also those which current state doesn't correspond the standard (2.8 ГСН А.2.2 - 1-2003).

2.8 List of the components and objects (recipients) SE being the subjects f the influence of the planned activity

To the potential subject of the influence (recipients) belong the territories around the construction sites.

2.9 List of the components and objects SE being in the non-normative condition

The objects of the non-normative condition are absent.

2.10 Necessary and sufficient sketch-maps. tables, etc.

The results of the analysis and the assessment of the changes of the components of the surrounding are shown in the map documents, situational schemes, general layout and corresponding table materials (2.10 ГСН А.2.2-1-2003).

2.11 Climate and microclimate (C/Mc)

If necessary the measures are provided in order to prevent the harmful influence of the planned activity on the climate and microclimate and the harmful changes in the surrounding provoked by this influence (2.12 ГСН А.2.2-1-2003).

Grounding of the necessity of the evaluation of C/Mc

The necessity of the climate and microclimate evaluation is specified by the pp. 2.11…2.12 2.11...2.12 ДБН А.2.2-1-2003 and ОНД-86 in the part of the execution of РЗА.

Evaluation of the retrospective, existing and future condition of the climate/microclimate with the background and normative indexes

Climate zone of activity

According to СНиП 2.01.01-82 the territory belongs to the category II-В.

Long-term retrospective and current climatic data

In the studied territory the moderate and continental climate with superfluous and sufficient moistening, in not hot summer, in the soft winter and in the warm autumn is created.

Temperature mode of the studied territory the unstable. Here characteristic winter thaw during which even in January the temperature sometimes exceeds in the afternoon +10°C, and in February can reach +15°C. More often, during winter thaw the temperature fluctuates from 0°C to +5°C. The average number of days with thaw, from December to February, makes 41 days.

In this territory distribution of temperatures is defined mainly by height above sea level to what the size of a temperature gradient (air temperature fall with increase on each 100 m testifies). The vertical gradient of temperature increases upon transition from the cold period of year by summer and from the highest hypsometric levels to the lowest. During the summer period of fall of temperature on each 100 meters of height on the average makes 0,6 °, and during the winter period - 0,4 °.

Average monthly air temperatures behind meteorological station data Slavskoe:

Beskyd	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
degrees C	-6,5	-5,0	-0,2	+5,1	+10,9	+14,0	+15,6	+14,6	+10,6	+5,9	+1,1	-3,4

Average air temperature in a year makes (+ 5,2 °C), an absolute minimum (-33 °C), an absolute maximum – (+ 37 °C). Average maximum temperature of the hottest month - +23°C; average temperature of the coldest period - 9,0°C.

The amount of precipitation depends on absolute height of the district and the provision of rather dominating winds, and also an exposition of slopes. The annual amount of precipitation fluctuates largely: their greatest number in separate years makes 1673 mm, the smallest - 844 mm. The most part of a precipitation here drops out during the warm period. The maximum of a precipitation (130 mm) is observed in July. In close dependence on a temperature mode and an amount of precipitation there is a humidity of air. Relative humidity of air during the warm period fluctuates from 75 to 82 %.

Formation and mode of a snow cover in this territory is characterized by a number of features owing to frequent thaw which are quite often accompanied by rains. Snow drops out at tops of mountains at the end of September, and in valleys - in November. In December the snow cover gains resistant character. The beginning of its destruction occurs in March. Intensive thawing of snow begins with April which leads to a full convergence of a snow cover within a high-rise zone of 600-1000 m in the third decade of this month, and in the first decade of May - in the areas located above 1000 m. Duration of the snow period in mountain valleys of-100-110 days, at tops of mountains - isn't less than 130 days.

Height of a snow cover - 1,2-1,4 m, depth of the freezing of soil according to a meteorological station Slavskoe - 0,90 m.

The characteristic of a wind rose which is used in dispersion calculations is provided in the table.

Table

Average annual wind diagram, %

	N	NE	E	SE	S	SW	W	NW
average	8	6	10	20	9	12	23	14

The prevailing direction of a wind during the winter period of year western and southwest, average speed of a wind of 2,2 m/s, during the summer period – northwest and western, average speed of 1,5 m/s. (according to a meteorological station Slavskoe).

Forecast of the change of the climate/microclimate with the absence of the designed activity

Climate change and a microclimate in the absence of planned activity, are caused by global processes of a drowning on a planet Earth.

Influences of planned activity on CLIMATE and MICROCLIMATE

The enterprises, establishments, the organizations and citizens – subjects of business activity are obliged according to international treaties, the consent to which obligation is provided by the Verkhovna Rada of Ukraine, to reduce and further completely to stop production and use of chemicals which harmfully influence an ozone layer, and also to carry out work concerning reduction of emissions of the substances which accumulation in atmospheric air can lead to negative climate changes [Art. 16 ЗУОАП, 2001] .

List of impacts (including mediate))

On the global changes of the planet climate influence the greenhouse gases: CO_2, CO, CH_4, NO_x, N_2O.

Qualitative and quantitative parameters of influences, danger degree

Emissions of hotbed gases from engines of cars are regulated by manufacturers and will be certificated. As a part of project documentation it is possible to estimate only their toxic influence on the population and vegetation.

Ranging of influences behind scale and value of consequences

Influences (including mediate) on climate and a microclimate which are necessary for considering at design of this object, are absent.

Forecast of changes of a microclimate at active and large-scale influences

Active and large-scale influences of this projected object on a microclimate are absent.

Features of a microclimate which cause growth intensity of influences of the designed activity on the environment.

Growth of intensity of influences of planned activity on environment is caused by ground inversions.

Possibility of climatic conditions which assist distribution of harmful types of fauna and flora

At operation of this projected object emergence of climatic conditions which assist distribution of harmful types of fauna and flora, is impossible.

Forecast of possible emergencies with microclimate changes

At operation of this projected object emergence of emergencies which will entail microclimate changes, is impossible.

Borders of zones of influences of planned activity on the climate/microclimate

The zone of influences of planned activity on climate and a microclimate is absent.

2.12 MEASURES for the prevention of the direct and indirect negative influences of the designed activity on the climate/microclimate

The direct and mediated negative influences of planned activity on climate and microclimate are absent.

Sizes of sanitary and protective zones and gaps

By criterion of negative influence of planned activity on climate and a microclimate sanitary and protective zones and gaps aren't necessary.

Actions for prevention of direct negative influences on the climate/microclimate

Direct negative influences of planned activity on climate and microclimate are absent, therefore actions for their prevention aren't necessary.

Actions for prevention of collateral adverse changes in the environment

Collateral adverse climate changes and a microclimate at the expense of planned activity are absent, therefore actions for their prevention aren't necessary.

Assessment of efficiency of actions

Actions for prevention of straight lines and the mediated negative influences of planned activity on climate and microclimate aren't necessary.

Residual influences on climate and microclimate

Residual influences of planned activity on climate and microclimate are absent.

SUITABILITY of a microclimate for object placement

Microclimate is suitable for placement of projected object.

Restrictions of planned activity on conditions of a microclimate are absent.

Necessary engineering preparation of the territory on conditions of a microclimate is absent.

2.13 Chemical pollution of the air

Need of an assessment of characteristics of the environment is defined by items 2.7, 2.13... 2.14 ДБН А.2.2 - 1-2003. Need of the analysis of influences of priority and specific polluting substances which contain in emissions of objects of the designed activity taking into account ***background concentration*** within ***zones of influence*** of these objects (2.13 ДБН А.2.2 - 1-2003) is standardly defined.

Impact of the designed activity on the AIR

The designed activity is the operation of the tunnel and it does not have sources of the emission of the harmful substances.

2.14 Characteristics of the sources of the emission of the pollutants

Considering that on the projected object during operation there are no sources which would form polluting substances, calculation of dispersion isn't made.

2.15 Physical contamination of the air

NOISE IMPACT

Level of equivalent noise which is formed by electric trains is subject to the analysis. Degree of danger defines excess of sanitary standard ПДУ.eqv. (equivalent maximum-permissible levels)

Restrictions behind level of noise influence

According to item 8.37 ГСП 173-96 for sources which create continuous noise throughout more than 30 mines, equivalent level of a sound of L.A.equiv. is estimated, at smaller time of influence – a maximum level of a sound of LA.max.

For transport streams defining there are equivalent noise levels. Equivalent (on energy) level of a sound of L.A.equiv. DBA of this changeable noise - level of continuous broadband noise which has the same root-mean-square sound pressure throughout a certain interval of time [СН 3077-84].

Table

Standard maximum permissible equivalent ПДУ.equiv. and maximum ПДУ.max noise levels (DBA) for territories of a different functional purpose

Name of the territory, normative source	ГДР.day/night	
	equiv.	**max**
Territories adjoin the living houses, medical and recreation establishments, boarding schools, children, infant establishments, schools [СН 3077-84; ДБН Б.2.4-1-94], sanatoriums, vacation hotels, libraries [ДСП 173-96], residential zones [ДБН 360-92**; СНиП II-12-77]	55 / 45	70 / 60
Amendment + 5 dBA for the living house being reconstructed [ДБН 360-92**] or for the construction already existing except the new buildings in it [СН 3077-84]	60 / 50	75 / 65
Zone I of the living and social construction [+10 - СН 3077-84; ДБН 360-92**; доп.16 ДСП 173-96] under the reconstruction [+5 - СН 3077-84, ДБН 360-92**]	70 / 60	85 / 75

Permissible level of equivalent noise in 2 m from structures of the I category (except hospitals and sanatoria), turned towards highways, the railways, and also sources of the aviation noise, is allowed to accept on + 10 DBA higher [СН 3077-84; ГСН 360-92 **; addition No. 16 ГСН 173-96]. The correcting amendment + 5 DBA on СН 3077-84 belongs to the developed building, except new structures in it.

Territory in 2 m from the fence construction of the building	ГДК.day/night	
	equiv.	max.
Zone of the I category of the living and social construction	70 / 60	85 / 75

Noise permissible levels in rooms are established under condition of ensuring standard ventilation of premises, chambers, classes, that is, at open window leaves, transoms, narrow shutters of windows [to СН 3077-84. Sanitary standards of admissible noise in placements of residential and public buildings and on housing estate territories]. Therefore in the rooms, which not equipped driving ventilation considers window sound insulation with an open window leaf, a shutter or a transom.

ГДР L.A.equiv. and L.A.max. of the noise (dBA) for the premises

Purpose of the premises, normative source	ГДР.day/night	
	equiv.	**max.**
Apartments, recreation establishments, boarding houses [СН 3077-84; ДБН Б.2.4-1-94]	40 / 30	55 / 45
Administrative buildings [ДБН Б.2.4-1-94]	50 / -	- / -

Calculations of the noise impact on the designed object

Noise influences of railway transport on the adjoining housing estate

Calculation of levels of L.A.equiv. of streams of railway trains is carried out according to a technique [The directory on protection against noise and vibration of residential and public buildings. – To.: Budivelnik, 1989]. For convenience of calculations tabular dependences are approximated by logarithmic and linear functions.

L.A.equiv. of the train = 40,91 + 9,82 lg L.п + 0,169V.way + 10 lg N.пар – 10 lg 0,13 R.рт,

where

L.A.экв	equivalent noise of the trains on the distance R.рт	dBA
V.перег > 20,0	velocity of the trains on the run	km/hour
L.п = 20	length of the trains	m
N.пар	intensity of the trains movement	trains/hour
R.рт	distance to the calculated point in this case the point at the border of СЗЗ – 100 m is specified	m

L.A.equiv. of the train = 40,91 + 9,82 lg 20 + 0,169*30 + 10 lg 6 – 10 lg 0,13*100 = 55,4 dBA.

Conclusion:

According to calculations, in the preportal territory the expected noise level of L.A.экв. day/night = 55,4/55,4 DBA at distance of 100 m (SZZ border) that corresponds standard ПДУ.экв. day/night = 70/60 DBA.

MEASURES for the decrease of the noise level

ГДР L.Aequiv. and L.A.max. for the noise (dBA) for the premises

Purpose of the premise, normative source	ГДР.day/night	
	equiv.	max.
Apartments, recreation establishments, boarding houses [СН 3077-84; ДБН Б.2.4-1-94]	40 / 30	55 / 45
Hotel rooms, hostel rooms [СН 3077-84; ДБН Б.2.4-1-94]	45 / 35	60 / 50
Administrative buildings [ДБН Б.2.4-1-94]	50 / -	- / -
Rooms of the cafes, restaurants, dining-rooms [СН 3077-84; ДБН Б.2.4-1-94]	55 / -	70 / -
Rooms of the shops [СН 3077-84; ДБН Б.2.4-1-94]	60 / -	75 / -

GDR of noise in rooms are established under condition of ensuring standard ventilation of premises, that is at open window leaves, transoms, narrow shutters of windows [СН 3077-84].

Room	Standard L.A.equi.d/n	L.A.equiv.d/ n	Exceed of the standard	dL.A.of the window	L.A.equiv.d /n
Apartments	40 / 30	55,4 / 55,4	+15,4 /+25,4	30	25,4 / 25,4

At construction of new houses about the Beskyd tunnel, use of double-glazed windows with dL.A. of the window sound insulation not less than 30 DBA is recommended. Use of noise protective windows provides standard noise level in rooms.

Specifications of an acoustic situation in the territory and detailed development of concrete actions for reduction of the noise will be provided in appropriate sections of the construction project of new houses (in need of such construction).

2.16 Impact of the THERMAL POLLUTANTS, ULTRASOUND, ELECTROMAGNETIC AND IONIZATION RADIATION

Grounding

As protective measures from defeat by an electric current at violation of isolation of electric networks protective grounding is applied. The network of grounding of the tunnel is connected to grounding devices of feeding substations a steel strip of 40x4 mm.

Grounding of each cable arm and cases of lamps is made to the grounding highway. Grounding of the certain consumers located in the tunnel, is made by means of zero protective veins of feeding cables. On transformer substation the device of individual grounding is provided. The general transitional resistance of a network of the nulling, measured in the places most remote from grounding conductors, shouldn't exceed 4 Ohm.

2.16.1 Natural and calculated evaluations of the impact of physical factors

Natural and calculated evaluations of the impact of physical factor are not necessary.

2.16.2. SUITABILITY of the physical impacts for the location of the object

2.16.2.1 Restrictions of the designed activity on physical conditions of PS

There are no restrictions of the designed activity on physical conditions of PS that is behind existence of sources out of standard influences of thermal emissions, ultrasound, electromagnetic and ionizing radiation.

2.16.2.2 Necessary engineering preparation of the territory on PS conditions

Additional engineering preparation of the territory on physical conditions of PS isn't necessary.

2.17 Geological environment

General characteristic of basic elements of the geologic environment

The tunnel is designed in the territory of East Carpathians. It is a zone of the Alpine folding, in particular – east spur alpide of the European Mediterranean in which formation played a role the big horizontal moving which complicated primary folded forms and have predetermined their modern integumentary form. For definition of tectonic development on a Pre-Cainozoic cut it is not enough data, but it is possible to consider that the folded and scrappy structure, characteristic for the modern Carpathians, is inherent also in a Pre-Cainozoic cut.

The considered area according to «The scheme of tectonic division into districts of East Carpathians» belongs to the Krosnensky zone of Carpathian folded area. According to classification “Geological map of Ukraine. The scale 1:1 000 000 (“The scheme structural tectonic division”) the area belongs to the external (flysch) Carpathians the Alpine folded construction. External Carpathians is an area of the late Alpine geosyncline which actively developed at the end of Yura, in chalk and a paleogene and passed the stage in a Miocene. In modern structure this geosyncline is expressed by flysch covers which are independent structural units (structural facial zones) as they separate one from another regional slopes (in particular, large Krosnensky).

Integumentary and radical breeds take part in a geological cut to depth of 132,0 m. An essential role Cainozoic deposits in capacity play some thousand meters; on a considered site flishevy deposits of a paleogene have dominating value.

According to «The scheme of division into districts of cover» is the A-1 area - the Mountain Carpathians. Not dismembered alluvial-delluvial deposits of a neopleistocene and the top pleistocene (edPIII-H) of adjournment are integumentary. Deposits are developed in the form of the narrow stretched strips and shapeless spots on rather flat water separate ridges and separate humps. Are presented loamy and sand and loamy educations with inclusion of a crushed stone material is more rare than blocks. Capacity of 1-5 m, in some cases, in the bottom of slopes to 10 m.

Under Pleistocene deposits there lie breeds of an Oligocene (the top paleogene - P3kr1 - a flysch formation of krosnensky suite. The Krosnensky suite – rough rhythmic grey flysch with the subordinated layers of argillites and siltstone, packs of alternation of sandstones, is more rare some slates. Sandstones fine-grained and siltstones are bluish-gray, with numerous streaks of calcite, folded; argillites are dark gray to the black. The general capacity of deposits of krosnensky suite to 1000 m. The capacity of thickness increases in the southwest direction.

Along the depth of the survey the following engineering and geological elements were specified:

№ EGE	Characteristics of the engineering and geological element (EGE)
1	Antropogenic soil. Rubble with the sandy clay filler up to 20 %.
1a	Top soil
2	Sandy clay with the layers of sandy silt, crushed stone and land waste from 20 to 40%, of hard and semi-hard consistency, with the layers of land waste and sandy clay at the foot
2a	Sandy clay with the layers of sand silt, crushed stone and land waste from 20 to 40%, mainly of hard consistency
4	Argillite and siltstone layers, massif, fractured, hard, with the layers of sandstone, soft
4a	Argillite and siltstone layers, semi-fractured, of the middle strength, with the layers of sandstone, soft
4б	Argillite and siltstone layers, mouldy, highly and semi-fractured, of low strength, with the layers of sandstone, soft
5	Sandstone massif, hard, with the layers of argillites and siltstone, unsoften
5a	Fractured sandstone, of the middle strength, with the layers of argillites and siltstone, unsoften
5б	Highly fractured sandstone, of low and middle strength, with the layers of argillites and siltstone, nonsoften

According to the appendix to СНиП 1.02.07-87 “Engineering researches for construction” [1] – the territory of researches belongs to 3 categories of complexity of engineering and geological conditions. The category of soil on difficulty of their development is accepted according to Table 1 ДБН 2.2-1-99 [14] and provided in the table of indicators of physical and mechanical characteristics of soil (the volume appendix 5 «The scientific and technical report on results of complex engineering researches», executed GP «The Kiev institute of engineering researches and the researches "Energoproekt", 2012).

Dangerous geological processes.

The region of the Carpathians and respectively platform of construction of the tunnel belongs to seismic dangerous areas. Seismicity of the territory of projected construction makes on a scale MSK-64 8 points.

From modern physical and geological processes and the phenomena in researches collapses and taluses of breeds are noted. Collapses are widespread in the structural and tectonic zones most lifted and dismembered by an erosion. Emergence of collapses is caused, as a rule, by a considerable precipitation in the form of a rain and snow, and also powerful winds. Also erosive processes (gullies, ravines, washout of integumentary deposits) on slopes are observed. Existing ravines now задернованы. Small numerous gullies are formed in storm rains. At visual survey of the territory of projected building of obvious manifestations of the sliding processes it is not revealed. However, on gentle slopes (10-20 °) at consistence change owing to moistening by rain and thawed snow of thickness of clay masses, and also at the cutting of the slopes there can be the sliding processes. As a rule, foldings in a cut have a southwest bias therefore landslides are more probable in this direction.

During the winter period there is a probability of an insignificant descent of avalanches. In high waters there is an undermining of coast of the rivers, water in a high water rises by 3-4 m.

CONCLUSIONS AND RECCOMENDATIONS

1. Results of complex engineering and geological researches on the route of projected construction of the Beskyd double-track railway tunnel of the Lvov railway are given in the Scientific and technical report on results of complex engineering researches for design stage justification «working documentation».

2. In the geomorphological relation the territory considered in the present report is in limits of the Krosnensky zone of the Ukrainian Carpathians.

3. In a geological structure an essential role Cainozoic deposits in capacity play some thousand meters; on a considered site flysch deposits of a paleogene have dominating value.

As a whole, character of the soil on a cut and on depth is reflected in engineering and geological cuts, and their description is provided in symbols to them.

4. In the territory of researches the water-bearing horizon, the horizon in alluvial-delluvial integumentary deposits and a water-bearing complex in radical paleogene deposits is met.

The water-bearing horizon in alluvial-delluvial top neopleystotsene and modern deposits (EDPIII-H) - the water-bearing horizon first from a surface. The horizon is dated to loam educations. Distribution sporadic. A food of the water-bearing horizon is carried out generally at the expense of an atmospheric precipitation, unloading – down on slopes.

The water-bearing complex in paleogene flysch deposits is dated for tectonic cracks in breeds. Waters non-pressure and pressure head (to 30 m). A food of a water-bearing complex in top flysch is carried out by the filtration of an atmospheric precipitation, unloading - in valleys of the rivers and streams. Level of a water-bearing complex the changeable.

Extent of aggressive influence of underground waters on a design from concrete and reinforced concrete, laying and plaster solutions, metal designs, fittings of ferro-concrete designs is given in table 1.

5. According to ДБН В. 1.1 - 12:2006 “Construction at the seismic area of Ukraine” seismicity of the territory of researches make on scale MSK-64 (the annex B to ДБН) according to the card ОСР-2004-S - 8 points with the period of repeatability of concussions once in 5000 years (probability of excess of seismic intensity within 50 years - 1 %).

According to table 1.1 ДБН В.1.1-12:2006 category of soil on seismic properties is II.

6. From modern physical and geological processes and the phenomena in researches collapses and taluses of breeds are noted. Also erosive processes are observed. At visual survey of the territory of projected building of obvious manifestations of the sliding processes it is not revealed. During the winter period there is a probability of an insignificant descent of avalanches. In high waters there is an undermining of coast of the rivers, water in a high water rises by 3-4 m.

7. Within a geological cut of a site of researches 10 engineering and geological elements, indicators of their physical and mechanical properties – in the appendix 5 are allocated.

8. The body of the tunnel passes in radical breeds of Krosnensky suite of a paleogene non-uniform on physical and mechanical properties. At a tunnel driving on separate sites can be met both the destroyed zones, and sites with the increased durability of soil (quartz sandstones).

It is necessary to provide the following actions for protection of constructions:

- at highway construction by open way and inserts of portals on a surface of slopes it is necessary to provide actions for an exception of shifts of integumentary loamy educations and block shifts of radical breeds at high подрезках and dredging of soil. It is necessary to observe technology section подрезок slopes, installation of the advancing and holding constructions against landslide provided with organized drainage and storm systems for interception of surface and underground water, arriving in borders of the territory mastered by construction. Carrying out geodetic and hydro-geological monitoring is recommended.
- at portal and tunnel construction in the massif of radical breeds of the most difficult there will be a driving: a) the thicknesses, the being characterized raised fracture, and the lowered durability; б) tectonic zones within which thickness strongly трещиновата, is shattered, in separate places обводнена. For an exception of inrushes and collapses of breeds, in process of a driving, fastening of a roof and tunnel walls is recommended.

9. On set of natural and technogenic, geomorphological, engineering and geological and hydro-geological factors the site of works belongs to the III category of complexity.

2.18 WATER ENVIRONMENT

In a above tunnel part of ridge, on east slope, the river Oporets, and on the western – the Vicha river originates. These small rivers eat generally atmospheric and flood waters, and also ground waters of the alluvial-delluvial water-bearing horizon.

For branch of existing streams on East portal the project provided the closed system of pipes and wells. Lengthening of drainage pipes are accepted from the reinforced concrete blocks in the size 1250Õ1500 (h) and 2000x2000 (h). Water is dumped in an existing waterway.

Water is dumped in the closed part of the bed of the river Vecha which will be constructed for construction.

Violations of hydrological and hydro-geological parameters of water objects and territories in a zone of influence of planned activity, influence on surface and underground water of specific polluting substances which arrive on water Wednesday when dumping sewage and filtration leaks, it is not expected.

2.19 Influences of planned activity on a condition SURFACE WATER

For collecting and assignment of an atmospheric precipitation from a front slope of East portal the project provided monolithic reinforced concrete tray by section 300x300 (h) with water dumping in an existing waterway.

For collecting and water assignment from the tunnel and a underlining drainage on the Western portal the project provided the closed system of pipes and wells.

For collecting and assignment of an atmospheric precipitation from a front slope of the Western portal the project provided monolithic reinforced concrete tray by section 300x300 (h) with water dumping in existing tunnel and further in drainage a tray located along projected Ry.

Calculation of rain waters is executed in compliance Construction Norms and Regulations of 2.04.03-85 items 2.11-2.18. Proceeding from a settlement consumption of rain waters the section of drainage trays is picked up. Settlement filling and speed in trays correspond Construction Norms and Regulations. The section of water throughput pipes on East and Western portals is accepted on the basis of hydrological data according to the specification of the Customer.

Ground and production water is taken away, at a driving from the Western portal of the tunnel flows in the clearing complex located on a building site of the Western portal.

From East portal of the tunnel water drainage from a face to the clearing complex, located on a building site of East portal is carried out on the drainage Ø108х4,5мм pipeline by means of the pump ЦНС 60-132.

During carrying out construction works the following sanitary-engineering systems are provided:

- fire and technological water supply (engineering networks of East and Western building sites);
- drinking water supply (imported water);
- economic and household sewerage;
- rain sewerage.

In the project use clearing a construction of rain waters of the Polish **JPR SYSTEM SWOK-100** form – a separator of oil products of productivity of 100 p/a with a settler is provided. Main complete set: settler, separation chamber, cartridge, system of automatic blockade, selection system and ventilation.

Separators of JPR SYSTEM are made according to norms of PN EN 858 and PN N 1852 that proves to be true existence of the European certificate of quality, and also existence of the conclusion to the state sanitary-and-epidemiologic examination of MOZ of Ukraine from 23.08.11 of No. 05.03.02-03/85664.

The separator can be used as the independent equipment for local cleaning of drains before dumping.

Exponents of cleaning of drains

Index	Units	Exiting from the separator
Weighted products	мг/л	10-12
Oil products	мг/л	0,3

Also the project provided the device of the **treatment facilities of the economic and household sewerage ЭКО-19**. Installations are intended for purification of economic and household sewage of objects of all-economic appointment, such as sanatoria and rest houses, hotels, boarding houses, comprehensive schools, office buildings, houses of room type and other similar objects to indicators at which the cleared water can be trained in soil (in a drainage well or a drainage trench) or to dump in a reservoir under condition of use of the block of tertiary treatment and disinfecting.

Way of cleaning:

In installation of sewage treatment of "EKO" two ways of cleaning are applied: the mechanical; the biological.

Mechanical cleaning represents removal from sewage of pollution which are in water in not dissolved look.

Large volume of primary settler, with duration of stay of sewage till 24 o'clock, provides uniform movement of sewage (averaging), allows to avoid fluctuation of volumes of sewage at a stage of biological cleaning, and also provides possibility of removal of the stabilized deposit through the long periods (till 1-2 years) during convenient time.

As a result of mechanical cleaning is removed to 50-60 % of mineral pollution, and BPK decreases for 30 %.

Biological cleaning is a destruction of an organic component of sewage by microorganisms.

Process of biological cleaning carries out difficult community of microorganisms

- bacteria, protozoa, a number of the highest microorganisms - in aerobic conditions (at existence in cleared water of the dissolved oxygen). Microorganisms are cultivated in active silt or a biofilm. Pollution of sewage are the power supply at which use they receive all necessary for their life - energy and a material for a constructive exchange (restoration of breaking-up substances of a cage, a biomass gain) for microorganisms.

Necessary level of concentration of oxygen is supported at the expense of supply of the compressed air from compressors thanks to what process proceeds in the environment rich with oxygen, i.e. favorable for activity of the aerobic microorganisms oxidizing organic pollution.

Any chemical reactants it is not used. Water on an exit is transparent also flavorless.

INSTALLATION includes 3 functional compartments:

- primary settler;

- activator (denitrifier and nitrifier);

- secondary settler.

Primary settler is intended for mechanical cleaning of a drain of not dissolved impurity by gravitational division, and also is the store of superfluous silt. The activator is intended for oxidation of arriving organic chemistry and ammonium salts in an oksichesky zone - a nitrifier, and also for elimination of the nitrate salts which were formed thus in an anoksichesky zone - a denitrifier.

The secondary settler is intended for separation of the cleared water from silt and includes calming partitions, an outflow trench, эрлифты for recirculation active and removals of superfluous silt.

Active silt from a settling zone with the help эрлифта comes back to a denitrifier. Simultaneous intake of sewage and returnable active silt provides their good mixture, and it in turn leads to effective withdrawal of pollution.

The superfluous silt which was formed in the course of biological cleaning periodically is taken away from a secondary settler in primary settler and further in process of accumulation is removed by the special car and is taken out on utilization on operating platforms of treatment facilities.

Supply of the compressed air in installation is carried out by the compressor placed in the special container close with installation through throttle gates of the air distributor and air pipes, fixed in clips on tank walls. For air dispersion in the activator the aerator executed from polypropylene and equipped with a rubber membrane are used.

EKO-19 has capacity (an expense of drains) 19 m3/d, number of served conditional inhabitants – 125 persons.

The noise level measured on the distance of 1 m from the working compressor, doesn't exceed 55 dB.

Standards of polluting substances are accepted on: “Rules of safety the ground waters from the pollution of the backflow water", approved by the resolution of the Cabinet of Ukraine from 25.03.99 No. 465, San PIN No. 4630-88 «Health regulations and norms of protection of a surface water from pollution», also are submitted in the table.

Table

№ Pos.	Index	Units	Концентрация загрязнений						
			Primary waste water	After the assembly	Effect of the cleaning %	After the secondary cleaning through the filter	Effect of the cleaning %	Standard	
								For the social environm	Requirements to the water of the water
1	Temperature	°C	10-20	-	-	-	-	-	+3
2	PH		6,5-8,5	6,5-8,5	-	6,5-8,5	-	-	6,5 - 8,5
3	Weighted materials	мг/л	433	15	96,5	2	99,5	15	+0,25мг/л
4	БПК5	мг/л	500	15	97	3	99,4	15	3
5	ХПК	мг/л	600	80	86,7	15	97,5	80	15
6	Nitrogen of the ammonium salts	мг/л	53			2	96,2		2
7	Nitrates	мг/л	-	-	-	45	-	-	45
8	Nitrates	мг/л	-	-	-	3,3	-	-	3,3
9	Phosphates	мг/л	22	-	-	3,5	84	-	3,5
10	Chlorides	мг/л	60	-	-	350	-	-	350
11	СПАВ	мг/л	16	-	-	0,5	97	-	-

If after installation disinfecting is if necessary applied, in water after cleaning indicators of BACTERIOLOGICAL pollution are normalized:

- coliphages - no more than 1000 BUO in 1 liter of water;
- lacto-positive intestinal sticks (LKP) - no more than 1000 in 1 l of water;
- viable eggs of helmints - shouldn't be contained in 1 liter of water.

2.20 Additional estimates of influences on a sea surface water

The territory doesn't border on the sea. Engineering protection of coastal territories isn't necessary.

2.21 Impact of the designed activity of the condition of the UNDERGROUND WATERS

Hydro-geological conditions. In the territory of researches the water-bearing horizon in alluvial-delluvial integument deposits and a water-bearing complex in radical paleogene deposits is met.

The water-bearing horizon in alluvial-delluvial top Pleistocene and modern deposits (EDPIII-H) - the water-bearing horizon first from a surface. The horizon is dated to clay deposits. Distribution sporadic, generally on the raised and lowered sites. Waters hydrocarbonate calcium, chloride-hydrocarbonate calcium, sodium-calcium, with a mineralization of 0,5-1,0 g/dm3. A food of the water-bearing horizon is carried out generally at the expense of an atmospheric precipitation, unloading – down on slopes.

The water-bearing complex in paleogene deposits flysch is dated for tectonic cracks in breeds. Waters flow-free and pressure head (to 30 m). Waters hydrocarbonate calcium, hydrocarbonate sodium-calcium, with a mineralization from 0,2 g/dm3 to 0,8 g/dm3. A food of a water-bearing complex in subsurface flysch is carried out by an infiltration of an atmospheric precipitation, unloading - in valleys of the rivers and streams. Level of a water-bearing complex the changeable. So in a well No. 4T in the course of drilling level of underground waters on depth of 12,4 m was fixed, and at achievement of depth of drilling of 57,8 m there was a complete water absorption and underground waters and flushing liquid. Complete and average water absorption was observed and in other wells (12П, 14П). In a well 3T level of underground waters is fixed on depth of 8,0 m. Drilling was carried out in heavy rains. It was in a day noted having self-given vent to waters from a well.

Possible water inflow to the tunnel proves to be true also results of the previous skilled forcings in a well 03b. The maximum inflow of water according to calculations made 4800 l/hours in a range of depths 65,2 to 69,0 m (absolute marks of 770,74-774,54 m), and in the range of 0,0-73,0 m – 6200 l/hours (absolute marks 766,74 – 839,74 m).

Movement of underground waters in fractured rocky breeds is characterized by a number of features among which it should be noted effect of double porosity, filtration anisotropy, existence in a layer of different (massif) of impenetrable borders, limits of heterogeneity, etc. The effect of double porosity is connected with existence of large cracks and emptiness.

According to СНиП 2.03.11-85 underground waters are weakly aggressive according to the content of aggressive carbonic acid in relation to concrete with brand on water tightness of W4. According to the content of sulfates of water nonaggressive in relation to concrete with brand on water tightness of W4. According to the content of chlorides on fittings of reinforced-concrete designs - nonaggressive at continuous immersion, weakly aggressive at periodic wetting (aggression degree on concrete with brand on water tightness of W4).

2.22 Measures for the prevention and decreased of the impact on the environment

East portal:

For branch of existing streams by the project the closed system of pipes and wells is provided. Water is dumped in an existing waterway.

For collecting and assignment of an atmospheric precipitation from a front slope of East portal the project provided monolithic reinforced concrete tray with water dumping in an existing waterway.

Western portal:

For collecting and water assignment from the tunnel and the underlining drainage on the Western portal the project provided the closed system of pipes and wells.

Water is dumped in the closed part of the bed of the river Vecha which will be constructed for construction. For collecting and assignment of an atmospheric precipitation from a front slope of the Western portal the project provided monolithic reinforced concrete tray with water dumping in existing tunnel and further in drainage tray located along projected railway.

Operation of object doesn't provide deterioration of waters.

Violations of a hydrodynamic mode, exhaustion of superficial and underground water resources, degradation of groups of water organisms isn't supposed.

2.23 Soils

In the geomorphologic relation the considered territory is in limits of the Krosnensky zone of the Ukrainian Carpathians.

Integument and radical breeds take part in a geological cut to depth of 132,0 m. An essential role Cainozoic deposits in capacity play some thousand meters; on a considered site flysch deposits of a paleogene have dominating value.

Not dismembered alluvial-delluvial deposits of a neopleistocene and the top Pleistocene (edPIII-H) of adjournment are integument. Deposits are developed in the form of the narrow stretched strips and shapeless spots on rather flat water separate ridges and separate humps. Are presented loamy and sand-clay educations with inclusion of the crushed stone material is more rare than blocks. Capacity of 1-5 m, in some cases, in the bottom of slopes to 10 m.

Under Pleistocene deposits there lie breeds of an Oligocene (the top paleogene - P3kr1 - a flysch formation of Krosnensky suite. The Krosnensky suite – is the loamy grey flysch with the subordinated layers of argillites and siltstones, packs of alternation of sandstones, is more rare some slates. Sandstones fine-grained and siltstone are bluish-gray, with numerous streaks of calcite; argillites are dark gray to the black. The general capacity of deposits of Krosnensky suite to 1000 m. The capacity of thickness increases in the southwest direction.

East portal:

Soil doesn't belong to the especially valuable. By results of researches of soil on sites brown wood of the middle depth, middle crushed soil is widespread on the alluvial-delluvial of the Carpathian flash of a moderate and cool belt which according to the nomenclature list of soil of Ukraine and scales of soil of the Lvov area belong to 191д to agricultural production group of soil. The customer pays losses to land users.

Western portal:

Soil doesn't belong to the especially valuable:

- brown mountain and wood superficial clay soil which according to the nomenclature list of soil of Ukraine belong to 198д to agricultural production group of soil;
- brown mountain and wood superficial hard clay soil, group 198 e;
- brown mountain and wood superficial soil, of the middle clay 198 recreation centers.

The customer pays losses to land users.

The project provides arrangement of dumps for the excavated soil at a tunnel driving.

The design volume of dumps of soil makes:

On East portal – 172,1 thousand m3 of soil; on the Western portal – 42,8 thousand m3 of soil.

The backfill of the soils on the **East portal** is provided in 2 stages:

1 stage:

- backfill of the soil is made to a mark 775,0. Delivery of soil to a dump is carried out by tunnel dump trucks of MOAZ on an access road from a building site, with its gradual elimination. Road plates are dismantled by the crane, taken out and stored in the building site territory.
- the backfill is made by the pneumatic bulldozer (capacity of 240 h.p.) with soil consolidation by skating rinks (weight 25т) layers 0,25м. Factor of consolidation 0,95. Planning of the slopes is made by the excavator.
- bosoms for the gabions are filled up with sandy soil layers of 0,25m. Soil consolidation in the constrained conditions is made by small-sized mechanisms. Factor of consolidation 0,95.

2 stage:

- the backfill of the soil is made from a mark 775,0 to the mark 785,0. Delivery of soil to a dump is carried out by tunnel dump trucks of MOAZ.
- during the measuring of the backfill and the raising of the horizon of works, road building with use of the plates dismantled at the first stage is carried out.
- the backfill is made by the pneumatic bulldozer (capacity of 240 h.p.) with soil consolidation by skating rinks (weight 25т) layers 0,25м. Factor of consolidation 0,95. Planning of slopes is made by the excavator.

Works on the backfill of the soil on the Western portal is provided to be made in the following sequence:

The soil developed at a driving of the tunnel, is delivered by dump trucks loading capacity 20т, to the dump territory, is unloaded, moves the bulldozer (capacity of 240 h.p.), are leveled by the layers of 0,25 m and condensed with skating rinks on pneumotyres (weight 25t), at a driving of 16 times on one trace. Factor of consolidation 0,95. Planning of slopes is made by the excavator.

Bosoms behind the gabions are filled with sandy soil layers of 0,25m. Soil consolidation in the constrained conditions is made by small-sized mechanisms.

Prior to the beginning of the construction works for the construction of a gabion protecting wall the following works must be made:

- branch of a surface water from a platform is organized;
- access roads are arranged;
- ways of movement of mechanisms, places of warehousing of a stone and gabion designs are designated, the assembly equipment and adaptations is prepared;
- gabion designs, geotextile and stone in necessary quantity are delivered;
- geodetic breakdown of axes according to the project is made.

Works on a construction of the gabion protecting wall include such technological operations:

- development of soil under the gabion protecting wall;
- geotextiles laying (density of 250 g/sq.m);
- the basis device from the mattresses (Renau mattresses);
- construction of the 2nd and the subsequent ranks of a gabion protecting wall;

Works on a construction of the gabion protecting wall is provided to make in the following sequence:

1 stage of works:

Device of the temporary road for work of construction equipment and stone warehousing. Development of a trench by the excavator, under the device of a protecting wall from габионов is made. Planning of a bottom of a trench under the device of a protecting wall is made. Laying of the first layer габионов begins with sites with the most lowered marks on all perimeter of a site of building, but taking into account the free spaces provided for the device of temporary roads, warehousing of materials, and also the technological spaces necessary for operation of cars and mechanisms. The geotextile is covered on all area of internal installation of gabion constructions. The first row of a protecting wall from габионов is formed by gabion mattresses of Renault of factory production. Their assembly and installation is made. Mattresses of Renault should be properly created and established, according to the instruction of assembly of gabion designs. The sheaf with already filled and earlier established mattresses of Renault is made. Filling of mattresses of Renault with a stone (M 600 and above) manually is carried out. Giving and stone loading in a body габиона is possible for organizing in the mechanized way with the subsequent its formation manually directly in габионе. The quantity of a stone in filled габионе should exceed the top borders габиона on 3-5 see. After leveling of a stone the cover by means of a knitting wire becomes attached.

2 stage of works:

The second and each subsequent number of the gabion protecting wall is formed of the prefabricated gabion boxes. Their assembly and installation is made. Boxes should be properly created and established to gabions, according to the instruction of assembly of the gabion constructions. The sheaf with already filled and earlier established gabion boxes is made. Filling of the gabion boxes with the quarry stone (M 600 and above) manually is carried out. For once fill only a half of the gabion box in the size, and then gabion is fixed in the middle of a horizontal sheaf over a stone layer then fill the second half of the gabion box. The gabion boxes are connected among themselves, forming the gabion construction. The covers of the gabions are necessary for drawing densely to forward sides and at the same time to tie with a wire.

2.24 Vibration impact

Vibrating influence of projected object exists.

All projected constructions influences of the railway getting to a zone – are calculated on temporary loading from a rolling stock of СК. All designs for which influence of wheel loading both for a construction is possible and for operation – are calculated on the concentrated wheel loading of НК. A loading class К, factors of reliability on loading, schemes of the appendix of loading – were accepted according to ДБН В. 2.3-14:2006 «Transport constructions. Bridges and pipes. Designing rules».

The applied modular standard beams and sections of square reinforced-concrete pipes are checked on bearing ability on possibility of perception of settlement loadings in these engineering and geological conditions. Qualitative and quantitative parameters of vibrating influences and degree of danger are considered in the project.

2.25 Flora and fauna, wildlife areas

The design site is generally covered with the wood, with a molded surface, on east slope the coniferous – a fir-tree and a fir, and on the western slope deciduous – a beech. It is possible to find small haying grounds and meadows in the woods. Natural slopes are abrupt, in most cases a slope corner from 25 ° to 40 °. The characteristic dominating florae, fauna and ecosystems: trees growing on a site which don't get under a building spot, should be kept.

2.26 Influences of planned activity on the condition of the environment

The list of influences (including mediated): air pollutions by emissions of NO2 harmful to plants. Technogenic climate changes and a microclimate are absent. Noise and other physical factors don't influence negatively on the environment. At the expense of operation of this projected object it is impossible emergence of climatic conditions which assist distribution of harmful types of fauna and flora. Restrictions of the designed activity behind the environment conditions are absent.

2.27 Estimates of retrospective, existing and future conditions of the environment under the background and standard indicators

The structure of vegetative groups and specific variety is enriched at the expense of compensatory plantings. The fauna remains without changes. Resistance of vegetation to diseases is typical for the Carpathians.

Forest and cultural activity was carried out, therefore productivity of vegetative groups was estimated.

The east portal - wood plantings of Slavskoe SE "Galselles".

The west portal - wood plantings of Top Volovetskoe forestry.

According to a conclusion to the materials of coordination of the location of the land lot the management of forestry doesn't object under a condition of:

- indemnification to forestry;
- cutting down of wood is made after the approved project and receiving the corresponding permissions.

2.28 Objects of natural and reserved fund (NRF)

There are objects of NRF in zones of influences of planned activity: Slavskoe SE "Galselles" and SE «Volovetskoe forestry».

Land, water and air ways of migration of animals cross the land lot. According to the technological task of STEA «Lvov railway» the project provides the device round portals of roundabout paths (on abrupt sites – ladders). In the protected territory buildings of protection and a construction of a special purpose are placed. On perimeter the protection and precautionary signs is established.

2.29 MEASURES for the protection of the environment

Prevention to exhaustion and degradation of flora is carried out by compensatory plantings. Influence on fauna is absent. Engineering preparation of the territory on conditions of the environment can provide a biological recultivation of a building site and compensatory plantings.

In the project performance of the recultivation of the land lots and a territory accomplishment (see project volume 2) is provided.

For prevention of destruction of the soil by the project strengthening of slopes and portals by monolithic concrete, the device of retaining walls and crops of herbs on top of return засыпки is provided. The project provided grass crops on return засыпке over periportal zones of the tunnel.

2.30 Evaluation of the impact of the designed activity on the social environment (SE)

Evaluation of the impact of the designed activity
on the social environment (SE)

For the purpose of improvement of railway traffic between Eastern and Western Europe via the existing Beskyd railway tunnel located on the 5th Crete international transport corridor on a site of Beskyd – Skotarskoe construction of the new two-acceptable tunnel is provided.

The new tunnel will replace the old existing single-line tunnel constructed in 1886г. The existing Beskyd tunnel will be maintained during all construction while the new tunnel won't be placed in operation, and should serve as the rescue tunnel during operation of the new tunnel. Therefore during all works on construction of the tunnel the constructional unity is provided and the minimum impact on the existing tunnel is had.

The strategic importance “The project of introduction of high-speed movement of passenger trains on the railways of Ukraine”, according to the order of the Cabinet of Ukraine from 11.03.098 No. of 263-R “About coordination of the location of the land lots”, caused of construction of the new tunnel.

2.31 The modern and future characteristic of the main social conditions of accommodation of local population in a zone of influences of planned activity

In a zone of influences of planned activity of the occupied places isn't present, except several militarized posts of protection, military barracks and small constructions for railroad workers around the periportal sites of the tunnel.

2.32 Estimates of positive and negative influences planned activity on social conditions of activity and satisfaction of requirements of local population, including its employment

The projected object provides improvement of railway traffic between Eastern and Western Europe.

2.33 Estimates of influences of the designed activity on recreation zones

Estimates of influences of the designed activity on zones of a recreation don't exceed the relevant sanitary standards for such zones, in particular 0,8 Pdk.Mr.

2.34 Forecast of influences of projected industrial facilities (I and II a danger class on ГСП 173-96) on a state of health the population

Industrial facilities I and II a danger class on ГСП 173-96 weren't projected.

2.35 MEASURES for the society protection

The main action for prevention of deterioration of conditions of activity of local population and its health are providing with the project of levels of influences which are much lower than sanitary standards.

2.35.1 Accounting of the public interests

The consumer of the designed activity provides (1.6...1.9 ДБН А.2.2-1-2003):

- informing of the population on carrying out discussion of planned activity;
- project discussion (the width is defined by scales of expected influences);
- granting design materials of the public according to the Declaration of intent.

Scales of expected negative influences of construction are very insignificant and also are much lower than sanitary standards.

Informing of the population is carried out in mass media.

Benefits of the public from the realization of the designed activity – is the improvement of railway traffic between Eastern and Western Europe.

The project «Construction of the Beskyd tunnel» is developed on the basis of a design assignment on object: «Construction of the Beskyd tunnel», approved by the Chief engineer os STEA «Lvov railway» on 15.07.2011.

2.36 Evaluation of the impact of the designed activity on the technogenic environment (TE)

The new double-track tunnel located on the 5th Crete international transport corridor on a site of Beskyd – Skotarskoe will replace the old existing single-line tunnel constructed in 1886.

The existing Beskyd tunnel will be maintained during all construction while the new tunnel won't be placed in operation, and should serve as the rescue tunnel during operation of the new tunnel. Therefore it is essentially important during all works on construction of the tunnel to provide constructional unity and to have the minimum impact on the existing tunnel. This circumstance is considered by appropriate sections of this project.

2.37 Negative influences of the designed activity on TE condition

On the construction of the East portal the construction of retaining walls in height from 3,0м to 14,0м, on the construction site of the West portal – height from 3,0 to 13,0 m is provided.

The project is developed taking into account the existing communications.

2.38 Complex actions for providing standard condition of the environment and its safety

Carrying out of existing underground communications according to ГСН requirements is the main action for ensuring operational reliability and preservation of technogenic objects.

The used equipment and materials are certificated in Ukraine.

2.39 Brief characteristics of the DESIGNED DECISIONS

Resource keeping measures

Storage and rational use of the water and energy resources are made by means of the use of the accounting devices.

Protective designed measures in the territory

Technological and biological restoration of the territory of the construction site. Gardening of the territory is provided according to the dendrological plan.

2.40 Calculation results of specification of the economic efficiency of the execution of the environment protection measures, if possible

On analogs the capital expenditure on the environment protection make 0,5-2, 35 % from the general costs of construction.

Economic efficiency of implementation of the environment protection actions is that thanks to their application there is a possibility to considerably reduce negative influence, both on the population, and on environment.

2.41 COMPLEX EVALUATION of the impact of the environment on the designed object

Restrictions of the designed activity on conditions of the surrounding natural, social and technogenic environment are absent.

The volume of engineering preparation of the territory necessary for observance of safety conditions of the environment, standard also is provided by the project.

2.42 COMPLEX EVALUATION of the impact of the designed object on the environment

- Noise and vibration during electric train passing. All projected constructions getting to a zone of influence of the railway, are calculated on temporary loading from a rolling stock of СК. All designs for which influence of wheel loading both for a construction is possible and for operation – are calculated on the concentrated wheel loading of НК.
- For protection of the tunnel against ground waters and removal of hydrostatic pressure the closed waterproofing with dumping of drainage water in the underlining drainage is provided. Branch of an atmospheric precipitation and drainage waters from the upland party of retaining walls is carried out with use of system of monolithic reinforced-concrete drainage trays.
- For branch of streams and the river Vicha use of modular square reinforced-concrete pipes with water dumping in monolithic wells is provided. And also monolithic reinforced-concrete rapid flows and gutters.
- Territory accomplishment.

2.43 COMPLEX EVALUATION of the impact of the designed object on the environment in case if the designed measures are executed

At the expense of optimization of design decisions and realization of the designed complex of actions the object practically won't carry out an adverse effect on environment.

2.44. Definition of degree of ecological risk of planned activity and influence on conditions of activity of the person

Extent of influence of ecological risk of planned activity and influence on conditions of activity of the person the insignificant.

2.45. Assessment of risk of influence of the designed activity on the environment

2.45.1. Evaluation of the social risks of the designed activity

Considering that at operation of the projected object there are no emissions of polluting substances, calculation of an assessment of risk of planned activity for pollution of atmospheric air isn't carried out.

The projected object is ecologically dangerous according to item 16 «Construction of the airports, railway junctions and stations, road service stations, river and seaports, railway main and automobile lines, undergrounds» additional E to ГСН А.2.2 - 1-2003.

According to item 5.20 GSP 176-93 «A housing estate it is necessary to separate from railway lines a sanitary and protective zone the in width of 100 m from an axis of an extreme railway track under condition of providing standard noise levels in adjacent objects and in the building territory.

At railway placement in dredging and at implementation of special noise protection events the sizes of a sanitary and protective zone are established taking into account providing in the territory of a residential development of standard noise levels, but it is not less than 50 m. Thus not less than 50 % of the area of a sanitary and protective zone should be planted trees and shrubs.

Distance from borders of garden sites to an axis of an extreme railway track it is necessary to accept not less than 50 m at obligatory use of the noise protection gardening in width of 25-30 m or other noise protection actions».

The projected object falls under sanitary classification enc. 9 GSP 173-96 from ***standard C33 of 100 m.***

Operation of object doesn't provide formation of harmful substances in atmospheric air. ***At the expense of optimization of design decisions at performance of nature protection actions and sanitary standards, the object practically won't carry out an adverse effect on environment.***

Risk of crisis changes of conditions of activity of the population are absent.

Zones of influences of menacing factors on health of the population are absent.

Zones of influences of menacing factors on constancy of the environment are absent.

Technical solutions on blowing and fire danger of the standard equipment concerning prevention of development of failures and localization of dangerous emissions are certain manufacturing plants and are certificated. Monitoring systems, automatic control, blocking, the alarm system and other means of accident prevention of standard equipment are defined by manufacturing plants and certificated.

The organizational and technical actions preventing a fire in the tunnel in its operation are provided the following:

- development of norms and fire safety regulations, instructions about an order of the address with fire substances and materials, about observance of a fire-prevention mode and actions of people at fire emergence;
- manufacturing and application of evident propaganda on ensuring fire safety;
- development of actions for actions of workers, passengers of trains on a case of emergence of a fire and the organization of evacuation of people;

- main types, quantity, placement and service of the fire equipment;
- all evacuation ways should be designated by indexes according to PB requirements;
- in underground constructions of the railway tunnel it is forbidden to smoke in the places not equipped for these purposes, to burden the evacuation ways (passes, cross passages), approaches to means of communication and a firefighting, and also to allow temporary warehousing in specified places of various materials, stock and equipment, to merge the fulfilled oils in drainage system. To portals the free entrance of fire trains, cars should be provided;
- the administration of service of operation should provide quarterly survey of drainage system of the tunnel and not allow accumulation in it combustible deposits.

2.46 Justifications of an optimality of the accepted complex of design decisions on criteria of providing

Requirements of the ecological and sanitary legislation are executed completely.

Operational reliability of objects of NTS is defined by manufacturing plants and are certificated.

2.47 Evaluation of the RESIDUAL EFFECTS of the designed activity

- ✓ Noise and vibration during the run of the trains
- ✓ Drainage waters

Residual influences are admissible, as requirements of the ecological and sanitary legislation are executed completely.

3. Evaluation of the influence on the Environment during the construction

The technical plan of the tunnel construction is designed according to the following references:

- the excavation of the tunnel is provided to be made from the East portal;
- the excavation of the tunnel is made by the drilling and blasting method;
- the concreting of the permanent lining is provided to be made using the mobile forms.

The construction of the tunnel starts from the preparatory period during which the installation of the periportal site is made. At the portals it is provided to construct the retaining walls, the periportal borrow pits are excavated, the leading piperoofs are installed, the entering and the further excavation of the portal borrow pits is made, the temporary buildings and constructions are built, the out and on-site engineering networks are assembled.

The duration of the preparatory period is specified taking into account the scope of works and makes for the East portal – 3,5 months, for the West portal – 5 months.

The concreting of the permanent lining is made after the tunnel excavation is finished.

The concreting of the permanent lining is made after the tunnel excavation is finished. Further the complex of works for the permanent arrangement is made.

3.1 Location and area of the construction sites, their characteristics

The Beskyd Tunnel and the designing site are placed along a railroad line which connects the railway station Lavochnoe on the north-east of the tunnel and the railway station Volovets on the south-west of the tunnel. The intermediate railway stations at both sides of the Beskyd tunnel are the station of Beskyd on the north-east and the station Skotarsky on the south-west of the tunnel. The tunnel and the design site geographically represent a part of East (Ukrainian) Carpathians. The Carpathians are a big simmering mountain rid stretching between the Czech Republic, Poland, Slovakia, Ukraine and Romania.

The new tunnel will replace the old existing single-line tunnel constructed in 1886.

In the administrative relation it is situated at the border of two regions: the East portal – in Lvov Region, the West portal – in Zakarpatye Region.

The existing Beskyd tunnel will be maintained during all construction while the new tunnel won't be placed in operation, and should serve as the rescue tunnel during operation of the new tunnel. Therefore it is essentially important during all works on tunnel building to provide constructional unity and to have the minimum influence on the existing tunnel. This circumstance is considered by corresponding sections of the given project.

At the East portal it is provided to build the temporary construction site.

The construction site is intended to locate the equipment and constructions for the supply of the compressed air, electric power, water for the local, technological and fire purposes during the tunnel excavation works.

All constructions and materials from the factories - suppliers are supplied by rail to the construction site of the East portal of a tunnel where they are unloaded and stored. The cast concrete and the solution are prepared using the designed concrete mixing machine located on the construction site of the East portal of the tunnel.

На стройплощадку Западного портала строительные конструкции, материалы и техника доставляются с Восточного портала по проектируемой автомобильной дороге.

The excavated earth is provided to be stored at the dump banks situated in the area of the East portal and around the village Skotarskoe on the distance of 2km from the West portal. The filling of the dump earth is made by impaction of the layers of 0,25m, during 16 drifts by the roller of 25t.

The workers work in shifts.

The builders will be located at the main site.

The delivery of the builders to the place of residence is provided by the railway transportation.

The delivery from the place of residence to the tunnel portals is made by the automobile transport. The twenty-four-hour operation is provided at the object.

According to the applicable normative documents the specialized military emergency rescue service during the excavation is provided.

In order to execute the assembly works for the systems of the electric power supply and ventilation equipment it is provided to engage the specialized installers.

The works of the land development and the assembly of the in-situ retaining walls at the East and West portals are made in confined spaces (intense movement of the railway transport in close proximity of the area of works, the support of the contact network of the railway are to be transferred and reassembled, the confined places of the storage of the construction materials, the working sites with the sharp broken ground).

Temporary buildings and constructions.
General layout.

The project of time building sites is executed taking into account adjoining territory, building and existing engineering networks.

The prodrivings on building sites provide access of fire motor vehicles to all buildings and constructions.

In connection with remoteness of the construction site from the objects of building industry it is provided to create the temporary construction site with the complex of constructions and arrangements providing normal process of the construction in face and on the surface.

The complex of time buildings and constructions takes place on two platforms:

1) the Preportal building site at East portal for the excavation of the tunnel.

2) the Preportal building site at West portal for the excavation of the tunnel.

The complex of the temporary buildings and constructions is defined in the minimum sizes taking into account the technology and the available experience in construction.

The sitting of the buildings and constructions is made taking into account their technological purpose, fire and sanitary norms.

The excavation of the tunnel and the construction of the lining is provided from the East portal.

To guarantee the directive terms of construction requiring the assembly of the large amount of concrete in the specified terms the uninterrupted supply of the concrete is provided.

The construction sites have the passages for the vehicles. The construction of the turning circles is provided. The exits are equipped with the gates and have the guard stations.

The project provides the fence of the construction site made of the corrugated steel sheet following the measures for the safety movement of the vehicles.

The water disposal is made by the surface method using the gutters along the trains with the further disposal of the storm and melt waters from the territory through the gutters into the purification facilities with the further disposal after the purification into the existing streams near the construction sites.

The surface of the construction site is made of the solid cast concrete based on the crushed stone.

The periportal construction site near the West portal is provided for the construction of the leading piperoof and the permanent lining (see the drawing № 26/11-220-8 ПР).

The set of the temporary buildings and constructions is specified in the minimum sizes taking into account the technologies and the construction experience.

The water disposal is made by the surface method using the gutters along the trains with the further disposal of the storm and melt waters from the territory through the gutters into the purification facilities with the further disposal after the purification into the existing streams near the construction sites.

The surface of the site is designed to be made of the prefabricated reinforced concrete slabs.

The construction site of the tunnel East portal.

The preportal building site at the East portal is intended for placing of objects of power supply of a face.

The platform has wrong in respect of an outline territory (the area 29130 м2.

The predominant points of the site are in the range from 796,0 to 797,5.

The construction of the retaining walls of 3,0m to 14,0м is provided. The construction of the retaining walls of 3,0m to 14,0м is provided. For the general organization of a relief on a construction site it is necessary to execute the following volume of excavations:

- excavation - 135000m3;
- filling of the platforms – 135000m3.

On a building site there are:

•Administration building;

•Medical center, CBACC;

•Repair shop;

•Concrete mixing machine;

•Construction laboratory;

•Warehouse of the inert materials (3pieces);

•Covered warehouse;

•Warehouse of the gas and propane balloons;

•Reinforcement warehouse;

•Reinforcement plant;

•Warehouse of the temporary excavation support (goods);

•Warehouse of the boring crowns and rock bolts;

•Compressor station;

•Receiver;

•Fuel station;

•Site for the construction equipment;

•Unloading and loading area;

•Ventilation room (input) with the air heaters;

•Ventilation room;

•Guard house (2pieces);

•Individual sanitary (3pieces);

•Access railways;

•Fence of the construction site;

•Wheel cleaning;

•Oil-product separator with the holding basin SWOK-100;

•Fire technological storage tanks;

•Fire pumphouse;

•Primary drain well;

•Purification facilities of the housing sewage system ЭКО-19;

•Final purification and disinfection block;

•Diesel electric power station (1 piece);

•Transformer station (2 pieces);

•Storage area of the excavated ground;

•Area for the unloading of the inert materials;

•Ramp for the unload of the inert materials;

•Area for the concrete unloading;

•Repair shop;

•Technological storage tanks;

•Purification facilities of the storm water drainage.

In the South-west from the East portal of a tunnel there is the short-term warehouse of blasting materials protected by a fence from a barbed wire.

The area of the protected site makes 1,1he.

Directly in site territory warehouse of the blasting materials and a protection premise are located.

Entrance to warehouse of the blasting materials is designed from a building site of the East portal on an access highway made of the prefabricated reinforced concrete plates of 0,3km length.

Pre-grade works

The main pre-grade works consist of the creation of the geodetic control network and the cleaning of the traffic lane.

The geodetic control network in-situ uses the signs fixing in the plan along the road the tops of the deviation angles and the main points of the curves, the points at the straight parts not rear than each 1 km and the horizontal control points along the road not rare than each 2 km. The main signs and the control points must have the dependable design as the columns and piles fixed outside the right-of-way according to the special requirements. Before the earth works the specification of the geodetic control network is made. Herein the location of all pickets and the plus points was made with their transfer outside the right-of-way; the additional horizontal control points of 3 m in height are fixed at the embankments outside the foot at the pits of more than 3 m of depth outside the slope crests; near the reconstructed artificial constructions the intermediate horizontal control points are placed at the uneven terrain; the circle and turning curves are set out and clouded and the intermediate points are fixed.

The detailed location can be made by stages along the road under construction, and as the scope of works is executed - with the backlogs taking into account the velocity of the stream.

Earthworks.

The earth bed is constructed with the advance of the further works (by the backlog). At the area of the backlog the earth bed must be made up to the designed mark, its surface including the slopes must be planned, the slopes must be fixed, the fail-safe operation of the drainage structures must be guaranteed.

The location of the earth bed should be made according to СНиП 3.01.03-84. During the location it is necessary to make life-size and fix all pickets and plus points, the tops of the deviation angles, the main and intermediate curve points and the additional storage tanks must be assembled near the high (more than 3 m) embankments and deep (more than 3 m) pits near the artificial constructions. The demarcation signs are duplicated outside the area of the execution of works.

The working location of the embankment contours, other constructions, graded elevations, the grade lines of the faces of slopes etc. is made from the fixed signs of pickets and horizontal control points not rare than in 50 m at the lines and 10-20 m at the curves directly before the execution of the corresponding technological operations.

The foot surface of the embankment must be fully cleared of the rocks and clods which diameter exceeds 2/3 of the thickness of the arranged ground level and of the foreign particles.

The impaction of the embankment foot to the required depth must be executed directly before the assembly of the upper layers. At the spreading of the existing embankments the surface of the slopes must

be loosened, at the slopes of the embankments of more than 2 m the sets-off of 2m in width must be made.

The land fill to the embankment must be made from the edges to the middle by the layers along the whole width of the ground surface including the slope parts. The further filling of the edge or the slope parts is unacceptable.

The excessive ground is taken away during the planning of the slopes at the final stage of the embankment construction and it is used for the filling of the waysides, assembly of the cross-overs, recultivation etc.

Each layer must be leveled following the designed longitudinal grade. Before the impaction the surface of the filling layer must be planned for the lean-to longitudinal profile with the angle of 20-40% to the edge of the earth.

The movement of the transport vehicles which fill the next layer to the embankments must be regulated full width.

The density of the ground after the impaction must correspond the requirements of СНиП 2.05.02-85.

The impaction of the loose loamy soils must be made, as a rule, by the cam or bar rollers or by the air-tired rollers with the partial dry load (of 10-16 t) and must be finished by the air-tired rollers of 25 t and more or by the self-moving vibrating rollers of 16 t and more.

The impaction of the soils must be made under the humidity close to the optimal.

The humidity of the soils impacted by the air-tired rollers in relation to the optimal value specified by ГОСТ 22733-77 must not exceed the limits (0,95-1,05).

With the humidity less than the optimal it is necessary to increase the quantity of the roller drifting, with the humidity less than the acceptable limits it is necessary to moisture the ground.

The final planning of the surface with the allotment of the cross slopes and the postcompaction of the upper layer, the planning and the slopes fixation must be made immediately after the earth level is assembled. All the damages of the surface provoked by the site transport ad the rains must be fixed directly before the construction of the pavement surfacing.

The impaction of the soils to the required density must be made till their freezing.

Off-site roads.

In order to install the construction site at the East portal it is necessary to arrange the following off-site roads:

- access road from the construction site to the dump bank;
- access road to the place of the execution of works of the arrangement of the Oporets River bed;
- access road to the place of the execution of works of the conduit pipes extension;

access road from the construction site to the warehouse of the blasting materials.

The consequence of the execution of works is specified in the drawing 26/11-373-8ПР “East portal. Schedule of the off-site roads construction”.

The way of the execution of works for the roads construction:

1. The land clearing is made along the road. The communications are laid (transferred). The geodetic location is made. The vertical planning is made.
2. The ground layer is cut by the digger with the bucket capacity of 1,0 m^2 and transferred by the digger (with the further use of this ground in the arrangement of the embankments).
3. The slopes are fixed by the shotcreting.
4. The filling of the road is made by the earth mover with the impaction of the ground by the air-tired rollers of 25 t with the layers of 0,25m passing the one step 16 times, the filling must be made using the local soils (modulus of deformation 20MPa and more). The presence in the filling of the wood, fiber materials, putrescible components and the easily strained construction waste is unacceptable. The size of the hard parts must not exceed 15 sm. The presence of the snow and ice is unacceptable.

5. The works for the arrangement of the earth surface are made by the digger with the bucket capacity of 1,0 m^2 and by the earth mover.
6. The embankments are executed of the local soils with the obligatory impaction (All types of works for the arrangement of the earth surface, the distribution, planning and impaction of the bottom and the foot must be executed strictly following the requirements of СНиП 3.02.01-87 "Earth constructions, foots and foundations", ДБН В. 2.3.-4-2007 "Automobile roads", ДБН А.3.2-2-2009 "Labor protection and industrial safety in the construction. General provisions").

Special attention should be paid to the impaction of the soils at the places of joining the engineering constructions. The impaction of the soils in the limited conditions is made by the small-size machines. The compacting factor of the bottom layer must be not less than 0,98.

7. The arrangement of the crushed stone bottom layer δ=150mm.
8. The assembly of the slabs is made by the auto crane with the capacity of 25t, the slabs are placed from the assembled covering using the method "from oneself".
9. After the covering is fixed its leveling and size of the joints are checked.
10. After the leveling and joint grouting of the surface the sealing of joints is executed by the rubber modified bitumen. The joints are filled for 2/3 of the height by the sand and cement mixture and on 1/3 by the rubber modified bitumen. Before sealing the joints must be carefully cleaned from dust and mud using the automatic brushes and by means of the blowing of the compressed air.
11. Reaching ПК3+33,25 the works for the construction of the temporary conduit pipes of the foundation blocks No.82 are executed in order to provide the passage across the Oporets river bed.

Main works.

The tunnel is constructed in the grounds which rock-hardness ratio under Protodyakonov fluctuates from:

- f=1,0÷2,0 - on the periportal areas;
- f=1,0 - in the fractured zones;
- f=3,0÷4,0 - the basic site of a tunnel.

In order to shorten the construction terms and put the building into operation in the limits of the directive terms the construction of the tunnel is provided to be made by the two counter headways from the East and West portals.

It is offered to excavate the tunnel using the drill and blast tunneling method.

Depending on engineering-geological conditions of building of a tunnel "Project" provides two basic technological schemes of the excavation.

The first scheme for the adverse conditions of excavation on the periportal sites, in zones of unstable grounds and in the fractured zones (hardness ratio of the grounds f=1,0÷2,0). For the prevention of a collapse of breeds by the project arch fastening by the advancing piperoof with the subsequent cementation through them of the grounds round chinks is provided.

The excavation of the calotte and the lower bench of a tunnel is made consistently. It is carried out the excavation of the calotte by counter headings, for all length of a tunnel. Then the lower bench is excavated. At the excavation of the calotte (step of 2m) time fastening of development by arches from a I-shaped №30 with the shotcreting by С20/25 (В25) is carried out. Backlog of time fastening from a heading doesn't exceed the size of the insert.

The excavation of the lower bench is conducted with the combined time fastening from the shotcrete covering reinforced by the reinforced arches and the mesh in a combination with the self-drilling anchors SDA R 32-S (IBO), with the step of 3м with short circuit of time fastening on a development sole on this site.

At an input in buildings of breed rather favorable on conditions (rock-hardness ratio of the grounds f=3,0÷4,0) on the basic site of a tunnel it is provided the transition to the second technological

scheme, according to which the excavation is conducted with the support of he excavation by the reinforced arches and anchors R 32-S (IBO), with the step of 2m.

The excavation of the lower bench is conducted with time fastening by anchors and shotcreting on the reinforced arches with the step of 3m with the short circuit of time fastening on a development soil. The assembly of a forehead of a heading is carried out by self-drilling anchors (IBO) R 32-S and the shotcrete δ =40mm.

The concreting of the permanent tunnel lining is made following such sequence:

•concreting of the invert of the linings;

•using the mobile timbering the arch and the walls are concreted.

Drilling and blasting.

The excavation of the double-track railway tunnel is provided by the project by way of the lower bench excavation with the ground working out in the heading by blasting.

Drilling during the bench excavation is provided in such way:

- during the calotte excavation – self-propelled double beam electric and hydraulic drilling machine Sandvik DT820-C;

- During the excavation of the lower bench - self-propelled double beam electric and hydraulic drilling machine Sandvik DT820-C;

The size of the entry is chosen depending on engineering and geological characteristics of the hills, parameters of the drilling equipment and makes:

- of the calotte – 2; - the lower bench – 3m.

The drilling spursare provided with a purge of the compressed air.

Compressed air moves from the mobile compressor installations located on the periportal platforms

Passport БВР is made at stage ППР and is specified by the results of not less than 3 skilled explosions.

For initiation of charges if the blasting materials the project provides non-electric system the ПРИМА-ЕРА-Т, ТУ У 24.6-14310112-043-2007.

In difference from the traditional means initiation of ПРИМА-ЕРА-Т provides the raised safety. Thanks to low sensitivity to wandering currents, it allows to make the blasting without a de-energization of the power equipment.

The detonation by the project is provided by a method of the subsequent delination with the obligatory application of the short and slow detonations of groups of charges in the following sequence:

- pre-cut;
- shaft;
- linear;
- bottom.

Delay time (time interval between detonation of groups of charges) taking into account a ground fortress is accepted 25ms.

As the bordering the sandy loam mixture is provided.

Excavating equipment for the tunnel construction.

The technology of the tunnel excavation provides the maximum mechanization and automation of labor-intensive processes of working out of hills and the device of time fastening of development.

For the anchor development fastenings installation Sandvik DT820-C capable to carry out some operations is used: drilling of the spurs, installation of anchors and installation the reinforced arches and frames of the temporary support.

The shotcreting of the temporary support of the excavation is made by the pneumatic Putzmeister Sika PM 4207 machine. Management of a nozzle is carried out, as from the stationary panel established on the chassis of the car, and by means of the remote cable. At use Putzmeister Sika the finding of workers in

dangerous periheading space is excluded. Erection of a constant tunnel lining is made with application of a mobile metal timbering witht the step of 12m.

Concrete delivery in a tunnel is carried out by the motormixers. Its laying behind the timbering is made by the concrete pumps CIFA PC 506/309 E6.

Conducting of the waterproofing works (control forcing for the lining, waterproofing installation) is provided from the technological carts equipped with a complex of load-lifting and other auxiliary devices. Technological carts are the portal type for motor transport admission.

Excavation of the tunnel.

The excavation of the tunnel is provided from the East portal.

For the maintenance of the safe excavation during the tunneling forwarding the heading the test pit is drilled L=45 m with the overlap of 15 m. The location of the holes is in the top third of the excavation sections. The drilled holes aren't planted round and further are used as unloading.

1. Preparatory works for the tunnel inserts of the East portal.

- Prior to the beginning of the excavation works within building sites the complex of the preparatory works is made:
- - arrangement of the temporary access roads and the arrangement and planning of the temporary job sites for the construction of the retaining walls of the in-situ piles ;
- - construction of the retaining walls of the in-situ piles;
- - arrangement of the periportal borrow pit protected by the retaining walls;
- - construction of the protective leading piperoof.

2. Excavation of the periportal borrow pits of the East portal and fixation of the slopes.

For the arrangement of the constant portal retaining walls on a building site time working platforms from which the assembly of the in-situ piles of retaining walls is made are arranged. Ground working out under the time working platforms necessary for manufacture of works on a construction of the in-situ reinforced-concrete piles is conducted by circles.

After the construction of retaining walls and a set concrete of durability of 100 % the excavation of the periportal borrow pit is made.

The ground of preportal borrow pit is excavated up to the design points of the construction site by the digger using the back hoe of the capacity of 1,0m^3 and is loaded into the dump trucks and transferred to the dump banks.

Works on fastening of slopes with the shotcrete covering and the drilling injection soil nails include the following technological operations:

- Working out of a ground by a dredge on depth of a circle at length of the bay with moving of a ground and loading to autodump-body trucks.

The cleaning and the planning of a slope to a design steepness is made manually under geodetic control.

- Installation of the reinforced mesh in design position and the further laying of the shotcrete covering of the prepared site of a soil slope.

The time interval between the cleaning and laying of the shotcrete should be reduced to a minimum (8-12 hours).

Drilling of the holes of ϕ102 mm on depth 6m (12m, 4m);

- putting of the soil nails of the reinforced bars in the holes;

- Filling of a hole with the cement mortal with В/Ц=0,4 through the injection pipe with its simultaneous extraction;

- Fixation of the soil nails on a surface of the shotcrete covering;

The fixation of the soil nails is carried out after the cement mortal gets he strength not less 1,5MPa.

- Drilling of the holes of ϕ102 mm on depth 6m under the punched drainage pipes.
- putting of the perforated drainage pipes.

Not to admit a silting and a punching contamination, the winding from geotextiles is used as the filter.

The supply of the ready shotcrete mortar to a point of the execution of works is made by the motormixers.

3. Construction of the protective piperoof from the East portal

On sites of inserts of a tunnel from the East and the West portals. On a site of insert of a tunnel the project provides arch fastening by the advancing screen from metal pipes with the subsequent cementation through them of the grounds round the holes (l=15m)., with the step of 1,5-2m on height, the ground is developed for the device of a working platform.

Over the advancing screen the mesh ϕ6A-III (step 150x150) is fixed.

The shotcereting is made on the mesh and in a forehead of the heading by means of Putzmeister Sika shotcreting machine to a designed thickness (δ =150mm).

The technology of the construction of the piperoof includes following operations:

1. The marking of the holes of the piperoof is carried out.
2. The drilling machine is established in the design position "Sandvik DT820-C".
3. The primary drilling by a crown ϕ45mm with a design corner 5˚30 ' concerning a line of axial symmetry on all depth of a hole is made. During drilling the designed position of a hole and its "leaving" size are controlled. In case of the "leaving" detection corresponding measures (drilling with "building lifting", updating of a design drilling corner) are taken.
4. Upon termination of drilling of the point hole its drilling out is made up to the design diameter by a crown ϕ102mm.
5. After the hole drilling to the design depth, installation of pipes of the protective piperoof (pipes ϕ73x7) is made. On a pipe the isolation valves are fixed and using the high-voltage hose the pipe is connected to the pumping equipment. The pumping is made for all length of the punched part of a pipe (in a direction from a face to a hole mouth) under pressure up to 0,5 MPa through the inventory tube (with extraction in process of pumping). The pumping works are considered to be finished if the solution isn't absorbed during 10÷15 mines at constant pressure.

For the assembly of the next hole the cycle of works is repeated.

Excavation and construction of the tunnel.

The project provides the excavation of the tunnel from the East portal.

Excavation works begin after the termination of works of the preparatory period, a construction of access roads, roads to ground sailings, warehouse of the blasting materials, process equipment adjustments on manufacture of concrete and reinforced products, and also arrangement of the portal.

The project provides the excavation of the by way of the lower bench tunneling with the excavation by blasting.

The technology of the calotte excavation of the tunnel includes the following technological operations:

1. Drilling of spurs along the entry.

Drilling is carried out according to passport БВР by the drilling machine "Sandvik DT820-C", providing split-hair accuracy and productivity of works.

2. Charging of spurs, detonation and ventilation of the heading.

The project provides non-electric method of initiation of charges «NONEL» which is completely safe to any electromagnetic layings, in particular from the existing electrified railway tunnel, thus, allows

to create schemes of detonation of charges with almost unlimited possibilities of management of processes of destruction of massifs of rocks.

It is possible to carry to advantages of system "NONEL": indifference to action of wandering currents, electrostatic charges and electromagnetic fields in a range of different frequencies; increase of efficiency owing to acceleration of preparation of explosion; depreciation of explosive works; high reliability.

3. Face reduction in a safe condition, a face frill.

After explosion and heading ventilation works are performed to make the heading safe, the characteristics of the air are specified, presence of refusals are checked.

The face frill is carried out by a tunnel earth mover «Liebherr – R924».

4. Ground loading.

Ground loading is carried out by a tunnel loader in dump trucks

«МоА3-7405-9586» and the ground is transported to the dump bank. Crushing of the oversized pieces of the ground is carried out by the earth mover «Liebherr – R924.

5.Fixation of the forehead of the heading, the arch and walls.

Upon termination of works on transportation of the ground the works are performed to fix the forehead of the heading of the arch and walls by a layer of shotcrete with the thickness of 40mm.

Every 10m o the excavation it is provided to fix the forehead of the heading by group of fiberglass anchors of 13m. Thus, the overlap of the fixation of the forehead of the heading makes 3m. Drilling is carried out by the drilling machine

"Sandvik DT820-C".

6. Advancing fastening

On sites of inserts, in the fractured zones, and zones of the unstable grounds advancing fastening from pipes ⌀73x7 with forcing through them of cement mortal is provided. Drilling of the holes is carried out by the drilling machine "Sandvik DT820-C" in two stages:

- The first stage.

Drilling of the point holes ⌀45мм for maintenance of design position and control of "leaving" of the hole.

- The second stage.

Expansion of the hole to design diameter ⌀102mm.

On the basic site of a tunnel advancing fastening of a roof of excavation by the self-drilling anchors SDA R 32-S (IBO) each 2 meters which interfere with loss of separate blocks of breed is provided.

7. Installation of the temporary support of the tunnel.

On insert sites in the fractures zones and zones of the unstable grounds it is provided to assemble the tunnel support of the I-shaped bars filling the interarch space with a layer of shotcrete on the steel mesh.

On the basic site it is provided to assemble the combined temporary support made of shotcrete reinforced by the reinforcing arches and the mesh in a combination with the self-drilling anchors SDA R 32-S (IBO). The arches are established from the tunnel lift «Himec 9915 BA» and are fixed in design position on the ground beams (for I-shaped arches) and are suspended on the anchors (for the reinforced arches).

After performance of works on installation of the temporary support the cycle of works is repeated.

On termination of excavation of the upper bench along the whole tunnel the lower bench is going to be excavated. The technological sequence of the operations is similar to sequence at the excavation of the upper bench.

Concreting of the permanent tunnel lining

Concreting of the constant lining is made after the termination of the tunnel excavation.

Concreting of the invert of the permanent tunnel lining is conducted in a direction from the East portal to the West portal, with the step of 12m. The supply of materials is carried out by the train МоА3 from the East portal.

1. The reinforced concrete pavement plates ПДП 3х1,2 Н30 are dismantled and the crushed stone from the temporary road pavement is digged. Preparation of a surface of concrete is made for the device of a waterproofing of the invert (cutting of the flows and concrete corners, cutting of the assembly elements of arches, seal of cavities in concrete and etc.).

On the prepared surface of concrete of the temporary support the waterproofing of the heading is made.

3. Installation of the reinforced frames of the invert of the permanent lining is made. In the location of the channel for the device of a tunnel drainage system the timbering is established. The face fixed timbering from a exhaust grid with elements of deformation seams is established.

4. Tray concreting is carried out. Concreting is conducted with the help of the concrete pump CIFA PS 506/309E6. Concrete is delivered to a packing place by the motormixers. Concrete consolidation is made by the site and deep vibrators.

All operations connected with reinforcing and concreting of a tray of a constant lining are made with extra care and carefulness to avoid waterproofing damage.

Concreting of the constant lining of the arch and tunnel walls is carried out after a set by concrete of a tray of a constant tunnel of 100 % of durability. Concreting of the arch and walls of the permanent tunnel lining is conducted in a direction from the East portal to the West portal of a tunnel. The supply of materials is carried out by the trains МоА3 from the East portal..

After a set concrete of a tray of the constant tunnel lining not less than 100 % of durability the channel for the device of a tunnel drainage system on all extent of a tunnel is filled with rubble. On rubble keep within road reinforced-concrete plates ПДП 3х1,2Н30.

For the concreting of the constant lining of the arch and tunnel walls the metal mobile timbering on rail to a course is used. Railway lines, for timbering moving on a site of works on the erection of the constant tunnel lining, are mounted on preliminary concreted tray of a tunnel. The bearing frame of a timbering is executed in the form of a portal providing the unobstructed admission of transport cars and the self-propelled equipment on a site of conducting of concrete works and backlashes between dimensions of vehicles and the equipment.

Ahead of a timbering, as a part of a complex of works on the concreting of the constant tunnel lining of the arch and tunnel walls, settles down two sites with technological carts for manufacture of works on the device of a waterproofing course and installation of the reinforced frames of the permanent lining. Behind a timbering the site with the technological tray for manufacture of works on control forcing of a solution behind the lining settles down.

Along the tray of the permanent lining from the rail Р-65 the temporary rails are made for movement of assembly carts and a mobile inventory timbering of the arch and tunnel walls.

Technological carts are made with constructive frames of portal type for maintenance of safe pass under them of people and journey of mechanisms, taking into account demanded standard distances and backlashes between dimensions of vehicles and the equipment. Carts, depending on the appointment, are equipped with all necessary mechanisms, the equipment and equipment for lifting and placing on them of cargoes with materials, and also safe work of people at height.

From the first cart preparation of a surface of concrete of time fastening under the waterproofing device is made, dismantle of ventilating pipes of the main airing of a tunnel is carried out, anchors of fastening of ventilating pipes, engineering networks, arms under cable lines of an electrical supply, illumination and communication are cut off.

On the laid waterproofing course (from the second technological cart) it is made installation the reinforced frames of the lining, mortgage details under fastening of engineering communications and internal arrangement of a tunnel, elements of deformation seams of the lining and delivery tubes for carrying out of control forcing of a solution for a constant lining are put.

After a set of the concrete of the permanent lining not less than 100 % of durability makes control forcing of cement mortal for a constant lining according to BCH 132-92 «Rules for the manufacture and acceptance of the works of pumping the mortar behind the tunnel lining».

Construction of the evacuation cross passages between the designed and the existing tunnels.

The excavation of the evacuation cross passages between the tunnels the project provides from the side of the designed tunnel after the construction of the permanent tunnel building.
The section of the cross passages is appointed 5,08x4,95 (BxH) on conditions of the organization of works of their excavation and of concreting taking into account the dimensions of cars and the mechanisms working in the excavation.

Excavation works are provided to be done by blasting. On a site (10м) adjoining an existing tunnel the excavation of the cross passages it is made manually by means of jackhammers.

Loading of the developed ground is carried out by a loader in the underground trains MoA3 and taken out to the dump banks.

The excavation of the evacuation cross passages is conducted by way of a continuous face with the steps of 2 meters, using the blasting way of the excavation and with the steps of 1м. During the excavation the borrow pit is reinforced by the I-shaped arches №30 with the shotcrete of C20/25 (B25) grade, laid on its internal regiments. Backlog of time fastening from a face doesn't exceed size of the entry.

For the concreting of the permanent lining of the arch and walls of the cross passage it is provided to use the portable inventory timbering. Before timbering installation on the prepared concrete of time fastening of walls and the arch the cross passages are mounted by the reinforced frames of the arch and walls of the cross passage linings.

After a set concrete of 100 % of design durability makes control forcing of cement mortal for a constant lining of the cross passage. For carrying out of control forcing, in the lining during its concreting, tubes are put.

Construction of the niches and chambers.

The excavation of the niches and chambers the project provides after the construction of the permanent tunnel lining.

Rock excavation is made by the blasting operations.

Loading of the developed ground is carried out by a loader in the underground trains MoA3 and is taken out to the dump banks.

During the excavation the temporary support of the excavation is made using the arches of the double-tee №30 with the shotcrete of C20/25 (B25) grade, laid on its internal regiments.

Construction schedule

The schedule of a tunnel construction is developed from following preconditions:

- construction of the tunnel is conducted from the East portal;
- excavation of the tunnel is carried out by means of blasting;
- concreting of the lining is supposed to be made using the portable frame.

The tunnel construction begins with the preparatory period during which the arrangement of the preportal platforms is made:

- working out of preportal borrow pits;
- temporary buildings and constructions are built;
- the assembly of the external and inner site engineering networks is made.

Duration of the preparatory period is accepted depending on the amounts of works and makes for:

- the East portal – 4,5 months;
- the West portal – 5 months.

On the portals the retaining walls are arranged, preportal borrow pits are excavated, leading piperoofs are arranged, the entry and the further excavation is carried out.

Concreting of the tunnel linings is conducted after the tunnel driving for all length.

Further the complex of works on constant arrangement is made.

Velocity of the execution of works specified by the schedule of the construction.

1. Excavation of the tunnel calotte – 93m/month;
2. Excavation of the lower bench of the tunnel – 180m/month;
3. Concreting of the tunnel permanent lining – 360m/month;
4. Construction of the evacuation cross passages – 20m/month;

Minor works and processes

1. Ground and underground transport.

At a construction of tunnels of the big sections most rationally for the dirt haul to use the motor transport, as is provided by the present project. For the dirt haul from a tunnel to the transloading at the East portal and the supply of the materials in a tunnel it is provided to use MoA3 74051-9586 with duplicating controls boards. Distance from the portal to the dump bank makes: from the East portal – 0,8 km, from the West portal – 2,0 km.

The supply of a ready mix in the tunnel from the concrete factory located on a building site at the East portal is made by the motormixers.

All cars with the diesel engines, working in underground conditions are supplied with neutralizers of exhaust gases.

The delivery of the workers from the industrial and living construction site to the periportal construction sited is made by buses.

2. Ventilation during the execution of works.

The project of the ventilation corresponds the requirements of "Safety rules in the construction of the undergrounds and the underground constructions" Moscow, 1994.

The tunneling is execute from one (East) portal in two stages. During the first stage the upper bench is mined. After the tunneling of the upper bench the lower bench is mined along the whole tunnel (second stage).

The tunneling of the upper and lower parts of the tunnel is made as the solid face with the rock excavation by blasting.

The rock is transported by the trains MoA3.

In order to clean the air during the drilling, excavation and rock removal the dedusting equipment is asembled in the tunnel.

The ventilation of the underground openings is made by the independent systems with the artificial ventilation for the intake using the mine fans.

Quantity of the ventilated air necessary to ventilate the underground openings is calculated according to such factors as:

- supply of the free air for the people working underground in the quantity not less than 6 m^3/min per a man;
- secure the minimum possible velocity of the air movement along the opening 0,15m/s;
- dilute the exhaust gases of the working transport to MPC;
- dilute the welding aerosols to MPC during the erection works.
- dilute the harmful gases of the explosion products.

Air flow rate for the design of the ventilation system is taken on the basic of the highest calculated factor.

The transport working in the tunnel must be equipped with the two-stage purification system of the exhaust gases.

During winter the portals of the tunnel are equipped with the tambours which prevent cold air leakage into the tunnel.

Unit during the ventilation after the blasting must be closed for the passage of the men with the sigh "Entry is forbidden, the unit is ventilated. Blasting!"

The project provides the following ventilation schemes:

VENTILATION SCHEME №1

The scheme is designed for the stage of the rock excavation and concreting of the primary support of the upper bench of the tunnel.

The principle of the system operation according to the scheme №1 is the following: the ventilation of the unit during the tunneling of the upper bench is made by the intake system from the East portal by means of the mine fan. Along the metal air duct ∅1600mm made of the iron sheets the fresh air is supplied which covers the pre-unit area, dilutes and removes the harmful gases along the excavation to the East portal.

During the cold season the external air of subfreezing temperature is heated by the air-heater assembled at the portal and then is supplied into th tunnel having the temperature of not less than +2 C. The emission of the contaminated air during the warm period is made naturally through the open gates (works only system П1), and during winter - by means of the exhaust ventilation system (B) outside the portal by means of the mine fan assembled in the site.

The system of the exhaust ventilation works only in winter when the gates are closed.

The air duct consists of the separate non deformated sections of 5m each, fixed with one another by means of the draw band joints.

The air duct is extended following the excavation and provides the distance to it not more than 15m. The air duct is fixed by means of the anchors HST M12x145 of "HILTI" company.

VENTILATION SCHEME №2

The scheme is designed at the stage of the execution of works for the rock excavation and the concreting of the primary support of the lower bench of the tunnel.

In order to avoid the natural draft between the portals (through tunnel ventilation) during winter the air-tight partition is placed at the West portal of the tunnel where the upper bench is excavated (Ventilation scheme №2a).

During summer the natural draft is taken into account, i.e. the air-tight partition is not placed (Ventilation scheme № 2b).

The operational mode of the tunnel ventilation system under the scheme №2a is the following:

The ventilation of the tunnel during the lower bench excavation is made by the input system (П1) of the mine fan from the East portal. Using the metal air conduit

∅1600mm laid during the excavation of the upper bench the fresh air is supplied washing the face space, diluting and removing the foul gases along the excavation to the East portal.

The outdoor air at low temperature is warmed by the air-heaters placed at the portal and is supplied into the tunnel with the temperature not lower than +2 C. The emission of the contaminated air is made with the closed gates using the ventilation exhaust system (B) outside the portal by the mine fan placed at the site.

The system of the exhaust ventilation (B) operates only in cold season with the closed gates.

The non-ventilated part of the tunnel is isolated from the passage of people by the metal mesh with the warning sign “No entry!” The renewal of works at this part of the tunnel is permitted only after the air has the concentration specified in the accepted norms.

The operational mode of the tunnel ventilation system under the scheme №2b is the following:

The ventilation of the face during the excavation of the lower bench is made by the input system П1 and П2 from the East portal using the mine fans. Thus the fan operating as the exhaust system during winter is switched for the input (П2).

The emission of the contaminated air is made naturally (with the open gates) directed to the West portal with the prevailing direction of the natural draft.

The ventilation of the part of the tunnel from the face to the West portal is made using the through ventilation.

During the excavation the one 5-meter section of the metal pipeline is dismantled dividing the pipeline for the vacant and operational parts; the flexible air conduit is connected to the operational part.

The flexible air conduit directs the air flow in the face of the excavation of the lower bench of the tunnel.

The steel air conduit is dismantled from the vacant part and is extended to the operational part securing the distance from the excavation to the air conduit with the movement of the excavating complex for not more than 15 meters.

VENTILATION SCHEME №3

The scheme is developed for a stage of the manufacture of works for the permanent tunnel lining.

The principle of the operational mode of the ventilation system under the scheme №3 consists in the following:

Ventilation during the process of the concreting of the tunnel lining is carried out using the inflow and exhaust ventilation.

Air moves and is selected by the axial mine fans from the East or the West portals in a prevailing direction of the natural draft..

Compressed air supply.

For the supply of the compressed air for the pneumatic tools and the technological equipment in the underground developments it is provided to lay the pipelines ⌀133x4,0 ГОСТ 10704-91*. In the process of the excavation of the heading the pipeline is extended.

The source of the compressed air supply is the compressor station located at the preportal construction sites of the East portal of the tunnel. Pressure in networks of compressed air must be no more than 7kgs/sm ². On a line of the underground pipeline through each 50 m operational gates (15кч18п ⌀y25mm) with the connecting branches are established.

In order to use the pipeline of compressed air as a fire-prevention waterpipe it is provided to connect these pipelines with installation of corresponding additional reinforcement every 400m.

Electric power supply of the construction sites. Construction electric power supply

1. Consumers, their characteristics

The basic consumers of electric power during the construction of the tunnel are: the compressor stations; the pump stations of the water supply; the complex of the excavation equipment in the heading; ventilation of the mines; boiler-houses; reinforcement shops; small motor loading of the other consumers at the sites and in the underground borrow pits; illumination of the buildings and constructions on the surface, illumination of the territory of the site, tunnel illumination.

2. Power supply voltage of the consumers

The project provides the application of the following pressure of the electric power networks:

•10 kV - for the power supply of the complete transformer substations of the construction sites and the underground borrow pits;

•380 W - for the power supply of the power loadings at the sites and in the tunnel;

•220 W - for the illumination of the constructions at the construction sites;

•36 W - for the illumination of the pre-excavation areas, ready sections of the tunnel;

•12 W - for the illumination of the mountain-building mechanisms.

The category of the electrical supply of the construction site must not be less than II. According to the category of the consumers, for consumers of the first category (fire pumps, illumination) automatic input of the reserve (ABP) is established being connected from the two independent inputs.

3. Electric power supply, electric equipment and lighting of the construction over-ground sites.

The transformation of the basic power pressure of 10 kV in pressure 380/220 W is planned to be carried out by means of the lowering complete transformer substations.

For the electrical power supply of the loadings being situated at the construction sites the complex transformer substations of type КТПГС 10/0.4 with the dead-earthed neutral are assembled.

The distributive networks 380/220 В are provided by the cable of АВБбШв, and for the mobile mechanisms - КГ cable, with the laying in the earth, along the construction (on the fence) and by the ground.

The lighting of the construction site is provided by the luminaires ЖКУ-250 on the supports of 10 m with lamps capacity of 250W and projectors ПЗС 35 with the lamps of the capacity of 500W on the mobile masts. The control of the external illumination is carried out automatically.

The calculated electric loadings of the construction sites (the land consumers) and their stability in the electric power supply are specified in the drawing 26/11-355-5ЭС, 26/11-358-5ЭС.

4. Electric power supply, electric equipment and lighting of the underground excavations.

For an electrical power supply of the mountain-building mechanisms at a tunnel construction it is provided at the East portal the one high-voltage cell ПККЗ-10 (ЯКНО-10) of the external installation and the one transformer substation of the explosion-proof type КТПВШ 10/0.4 kV. This transformer with the isolated neutral supplies the electric power to the underground consumers.

The control of isolation of the power chains feeding the equipment of the underground excavations, and in the feeding cables the illumination is made by means of the protection devices of АЗУР.3 type with the influence on the switching-off and the emergency sound alarm system.

The electric equipment is applied to reception and electric power distribution to the low party in the protected, condensed and dustproof execution. For management and protection of electric receivers the automatic switches of AB type are used.

For the power supply of the mobile electric drive equipment the cabtype cable of КГЭШ type is used.

The tunnel illumination is provided to be executed with the luminaries НСРО with the electric filament lamps of 100 W, established every 6 m in chessboard order on the both sides. In the loading center the mine transformers ТСШ-4 380/38 are established. Pressure of a network is 36 W (see the drawing 26/11-357-5ЭС, 26/11-360-5ЭС).

The lighting networks are laid using the cable ВБбШнг. The illumination of the ready excavations is carried out on both sides, the power supply is provided from the different sources through the automatic reserve input.

The rated luminance of the workplaces provides 30 – 50 Lk taking into account that on the excavation cars and mechanisms there are the stationary built-in luminaries

5. Calculation of the electric loading

The calculated electrical loadings of the underground developments of the tunnel, galleries and their stability of the electric power supply are specified in the drawing.

6. Account of the electric power

The account of the electric power is provided on the side of10 kV in the cell ПКК3-10 (ЯКНО-10) for the mine substation of КТПВШ type on the side 0.4 kV in КТПГС 10/0,4 which are established at the construction side.

7. Protective grounding and protective nulling

For the electric power supply of the receivers located in underground developments, the system with the isolated neutral of windings of the lowest pressure of power transformers is used. The project provides the device of the protective grounding being connected to the metal cases of the electrical engines, assemblages, starting equipment, cover of cables and other metal constructions which can appear under tension as the result of the damage of the isolation of the electric network.

The earthing device consists of the grounding conductors hammered into a ground at the portals of a tunnel and the gallery, and grounding highways. Herewith the maximum natural grounding conductors are used.

The general transitive resistance of the network of the grounding, measured in the most remote places from grounding conductors shouldn't exceed 2 Ohm.

In the underground developments the general network of grounding from the two highways which all elements subject to grounding, and also local grounding conductors join is arranged.

Mobile electric installations join highways of the grounding by means of the earthing veins of the flexible cables.

For the electric supply of the receivers located at the construction sites, the system with the dead-earthed neutral power transformers is applied and the device of the protective nulling is provided. The grounding system is similar above stated, as the nulling highway the earthing veins of power distributive network are used.

The general transitive resistance of the nulling network measured in the most remote places from the grounding conductors, shouldn't exceed 4 Ohm.

Communication during the construction.

On the construction site it is provided to assemble the mobile telecommunication.

The local phones are established in the places provided by the plan of the accident elimination. The application of the portable radio sets for the communication between the remote sites of the construction site is assumed.

3.2 MEASURES for the decrease of the CONSTRUCTION influence on the environment

The design assignment provides the construction of the new double railway tunnel in order to improve the railway transportation between the Eastern and Western Europe, the laying of the necessary engineering networks, the retaining walls and the land development.

The new tunnel will replace the existing one-way tunnel built in 1886.

The existing tunnel will be used during all construction until the new one is put into operation and will be used as the emergency rescue tunnel during the operation of the new one. Thus, it is very important during the execution of all tunnel construction works to provide the structural unity and the minimum influence on the existing tunnel.

Taking into account the hydrogeological conditions of the construction area (existence of the pressure ground waters, and the probable water inflows) in order to avoid the entrance of the ground waters into the tunnel it is provided to use the waterproofing geomembrane of 2.0 mm along the whole tunnel. To provide the water disposal from the arch and walls of the tunnel into the underlining drainage and to protect the membrane from the damages caused by the roughness of the draft concrete – the drainage layer of the geotextile of 4 mm is laid between the temporary support and waterproofing membrane. The same system (waterproofing + drainage) is provided for the retaining walls. The drainage water along the geotextile comes to the drainage perforated pipe and moving along the polyethylene tube on the front wall is disposed into the gutters.

To dispose the atmospheric precipitations and drainage waters from the uphill side at the retaining walls and at the construction site the system of the solid reinforced concrete gutters is provided. For the

disposal of the stream and the Vicha River it is provided to use the prefabricated square reinforced concrete pipes with the disposal of water into the solid wells. And also the solid reinforced concrete runners and water cushions.

The excavated ground during the tunneling will be stored at the dump banks being located at the lands according to the applicable legislation. For the transportation of the excavated ground during the tunneling the project provides the construction of the automobile roads with the prefabricated reinforced concrete surface.

During the assembly of the damp banks the project provides the protection from the rain washway by the fastening (fences) of the dump banks by the gabion retaining walls. Due to the gabion cell structure the high penetration of the gabion constructions for the water and air is provided. The characteristics of the gabions provide their structural unity, strength, penetration and ecological compatibility.

In time the gabion constructions melt in the surrounding and become the part of the natural landscape.

Before the start of the works for the construction of the gabion retaining wall the following works must be executed: the disposal of the surface waters from the construction site must be arranged, the access roads must ne constructed, the way of the machines moving must be specified, the places of the storage of the stone and gabions must be stated, the assembly tooling and devices must be prepared, the gabion constructions must be delivered, the geotextile and the stone must be supplied, the pegging-out of the axis must be made according to the project.

At the construction site there are places for the settling of the machines and the places for the vehicles wheel washing. The settling of the machines is prohibited in the area of the operating gas pipe line, heat pipe, electric and telephone cables.

3.2.1 Protection of the ATMOSPHERE from the CHEMICAL POLLUTION

In order to calculate the influence on the surrounding during the construction it was in details analyzed the technological processes at the construction site of the East portal as it is the main one. The influence of the construction site of the West portal is the same.

Characteristics of the construction sources of the chemical influence

During the reconstruction and construction the following construction machines and devices will be used (the final scope will be corrected in PVR):

Necessity in the main vehicles, construction machines and mechanisms is specified in the table 1.

Table 1

Name of the main vehicles and mechanisms	Type or mark	Quantity	Notes
1.Track-mounted crane	ДЭК-251	1	
2 Autocrane	КС-55727	1	
3.High sided truck	ГАЗ-33086	1	
4.Dump truck	КрАЗ-65032	2	
5. Digger 1m³	ЭО-3523А	1	
6.Digger with the rig	ЭО-5123.50	1	
7.Wheel loader	JCB456ZX	2	
8.Earthmover	Komatsu D85EX-15	1	
9.Compressor	XRVS	1	
10.Welding unit	АДС-2П-500	1	
11.Concrete mixer truck	АМ-7ДО	2	
12.manual portative vibrator	ТСС РВП-	2	
13.Pneumatic roller	ДУ-55	1	

Note:

1. This table serves for the approximate calculations of the existing vehicles during the construction. The specification of the need for the vehicles, machines, devices and stuff is made by the construction and assembly department after the development of the working plan according to the specific conditions.
2. The specified in the list marks are not obligatory to be used during the execution of works and can be replaced by the others (available) with the same technical characteristics.

Mass of emissions in the course of construction on a building site of East portal.

In calculations work 3 DES (sources No. 25, 26) which are reserve sources of power supply is considered.

Table

Nitrogen dioxide

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
4	0,00012	0,000541	0,00012	0,000541
8	0,00012	0,000541	0,00012	0,000541
9	0,001486	0,01424	0,001486	0,01424
12	0,008667	0,007910	0,008667	0,007910
13	0,000227	0,002487	0,000227	0,002487
14	0,000192	0,000866	0,000192	0,000866
23	0,001486	0,01424	0,001486	0,01424
25	0,686667	0,138432	0,686667	0,138432
26	0,686667	0,138432	0,686667	0,138432
∑	**1,385632**	**0,317689**	**1,385632**	**0,317689**

Carbon oxide

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
4	0,000497	0,000002	0,000497	0,000002
8	0,000497	0,000002	0,000497	0,000002
9	0,04958	0,04784	0,04958	0,04784
12	0,012336	0,001222	0,012336	0,001222
13	0,002250	0,010315	0,002250	0,010315
14	0,000796	0,003587	0,000796	0,003587
23	0,04958	0,04784	0,04958	0,04784
25	0,600000	0,12096	0,600000	0,12096
26	0,600000	0,12096	0,600000	0,12096
∑	**1,315536**	**0,352728**	**1,315536**	**0,352728**

Hydrocarbon C_{12}-C_{19}

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
9	0,01958	0,0189	0,01958	0,0189
18	0,0000063	0,000199	0,0000063	0,000199
20	0,00000012	0,00000001	0,00000012	0,00000001
22	0,00000011	0,0000005	0,00000011	0,0000005
23	0,01958	0,0189	0,01958	0,0189
25	0,171667	0,034608	0,171667	0,034608
26	0,171667	0,034608	0,171667	0,034608
∑	**0,38250053**	**0,10721551**	**0,38250053**	**0,10721551**

Silicon oxide

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
4	0,00049	0,002274	0,00049	0,002274
8	0,00049	0,002274	0,00049	0,002274
13	0,000584	0,000899	0,000584	0,000899
∑	**0,001564**	**0,005447**	**0,001564**	**0,005447**

Fluorides (well soluble)

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
13	0,000879	0,001353	0,000879	0,001353
∑	**0,000879**	**0,001353**	**0,000879**	**0,001353**

Chrome oxide

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
4	0,000003	0,000015	0,000003	0,000015
8	0,000003	0,000015	0,000003	0,000015
13	0,000031	0,000317	0,000031	0,000317
14	0,000005	0,000247	0,000005	0,000247
∑	**0,000042**	**0,000594**	**0,000042**	**0,000594**

Titan oxide

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
4	0,000630	0,000629	0,000630	0,000629
8	0,000630	0,000629	0,000630	0,000629
13	0,000089	0,000139	0,000089	0,000139
∑	**0,001349**	**0,001397**	**0,001349**	**0,001397**

Dust inorganic 70- 20% SiO_2

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
10	0,55	5,7816	0,55	5,7816
11	0,07	0,3238	0,07	0,3238
24	0,00768	0,0355277	0,00768	0,0355277
27	0,00768	0,0355277	0,00768	0,0355277
28	0,00768	0,0355277	0,00768	0,0355277
∑	**0,64304**	**6,2119831**	**0,64304**	**6,2119831**

Ferric oxide

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
4	0,00835	0,023482	0,00835	0,023482
8	0,00835	0,023482	0,00835	0,023482
12	0,043110	0,005677	0,043110	0,005677
13	0,008415	0,032994	0,008415	0,032994
14	0,000513	0,009251	0,000513	0,009251
∑	**0,068738**	**0,094886**	**0,068738**	**0,094886**

Manganous oxide

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
4	0,00099	0,003313	0,00099	0,003313
5	0,00099	0,003313	0,00099	0,003313
8	0,00099	0,003313	0,00099	0,003313
12	0,002250	0,000291	0,002250	0,000291
13	0,000811	0,002428	0,000811	0,002428
14	0,000137	0,000618	0,000137	0,000618
∑	**0,006168**	**0,013276**	**0,006168**	**0,013276**

Hydrogen fluoric

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
13	0,000282	0,000434	0,000282	0,000434
∑	**0,000282**	**0,000434**	**0,000282**	**0,000434**

Aluminium oxide

Дж	2012		2013	
	т/сек	т/рік	г/сек	т/рік
4	0,000546	0,001010	0,000546	0,001010
8	0,000546	0,001010	0,000546	0,001010
∑	**0,001092**	**0,00202**	**0,001092**	**0,00202**

Metal dust

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
1	0,006	0,027756	0,006	0,027756
2	0,002	0,009252	0,002	0,009252
3	0,006	0,027756	0,006	0,027756
5	0,006	0,027756	0,006	0,027756
6	0,002	0,009252	0,002	0,009252
7	0,006	0,027756	0,006	0,027756
∑	**0,028**	**0,129528**	**0,028**	**0,129528**

Emulsoid

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
15	0,000001	0,000005	0,000001	0,000005
16	0,000024	0,000110	0,000024	0,000110
∑	**0,000025**	**0,000115**	**0,000025**	**0,000115**

Pairs of gasoline

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
17	0,0024886	0,0784818	0,0024886	0,0784818
19	0,0000183	0,0000011	0,0000183	0,0000011
21	0,000146	0,0000027	0,000146	0,0000027
∑	**0,0026529**	**0,0784856**	**0,0026529**	**0,0784856**

Carbon black

Дж	2012		2013	
	г/сек	т/рік	г/сек	т/рік
25	0,033333	0,00672	0,033333	0,00672
26	0,033333	0,00672	0,033333	0,00672
∑	**0,066666**	**0,01344**	**0,066666**	**0,01344**

As a result of carrying out construction works on a building site of East portal the maximum single emissions of polluting substances are predicted:

Table

		2012		2013	
		g/sec	t/year	g/sec	t/year
301	nitrogen dioxide	1,385632	0,317689	1,385632	0,317689
337	carbon monoxide	1,315536	0,352728	1,315536	0,352728
2754	hydrocarbons	0,38250053	0,10721551	0,38250053	0,10721551
123	ferric oxide	0,068738	0,094886	0,068738	0,094886
143	manganous oxide	0,006168	0,013276	0,006168	0,013276

323	silicon oxide	0,001564	0,005447	0,001564	0,005447
10265	emulsoid	0,000025	0,000115	0,000025	0,000115
328	Carbon black	0,066666	0,01344	0,066666	0,01344
342	Hydrogen fluoric	0,000282	0,000434	0,000282	0,000434
343	Fluorides wel soluble	0,000879	0,001353	0,000879	0,001353
2909	Dust inorganic 70-20%	0,64304	6,2119831	0,64304	6,2119831
203	chrome oxide	0,000042	0,000594	0,000042	0,000594
10226	titanium oxide	0,001349	0,001397	0,001349	0,001397
101	aluminium oxide	0,001092	0,00202	0,001092	0,00202
10431	Metal duct	0,028	0,129528	0,028	0,129528
2404	Pairs of gasoline	0,0026529	0,0784856	0,0026529	0,0784856
	TOTAL:	**3,90416643**	**7,33059121**	**3,90416643**	**7,33059121**

The list of polluting substances which will be supplied to the atmospheric air during tunnel construction

Table

Code	Name of the component	ПДК.м.р., ОБРВ, мг/м^3	Danger class	Intensity of emission of the pollutants	
				г/с	т/год
301	nitrogen dioxide	0,2	2	1,385632	0,317689
337	carbon monoxide	5,000	4	1,315536	0,352728
2754	hydrocarbons	1,000	4	0,38250053	0,10721551
123	ferric oxide	0,400	3	0,068738	0,094886
143	manganous oxide	0,010	2	0,006168	0,013276
323	silicon oxide	5,000	1	0,001564	0,005447
10265	emulsoid	0,050	2	0,000025	0,000115
328	Carbon black	0,150	3	0,066666	0,01344
342	Hydrogen fluoric	0,020	2	0,000282	0,000434
343	Fluorides well soluble	0,030	2	0,000879	0,001353
2909	Dust inorganic 70-20%	0,500	3	0,64304	6,2119831
203	chrome oxide	0,0015	3	0,000042	0,000594
10226	titanium oxide	0,500	4	0,001349	0,001397
101	aluminium oxide	0,010	2	0,001092	0,00202
10431	Metal duct	0,400	-	0,028	0,129528
2404	Pairs of gasoline	5.000	4	0,0026529	0,0784856
	TOTAL:			**3,90416643**	**7,33059121**

The works are executed on the different heights. For reliability 2 m are accepted.

Design procedure of pollution of the atmosphere (RZA)

The design procedure of pollution of the atmosphere (RZA) completely coincides with estimates of operational pollution (see this volume of OVOS). The size of a plane source building site is accepted 700 x 550 m. Charts of dispersion of pollutants in atmospheric air were estimated by a settlement way by technique OND-86 by means of the approved software of "EOL". Pollution estimates (listing with PS "EOL") are provided on schematic maps and is lower in the table. Basic climatic data presented in the subsection "Climate". All values of concentration are approximated in the big party to 0,01 maximum concentration limits.

Determination of expediency of carrying out RZA

For acceleration and simplification of calculations of ground concentration of polluting substances according to the item 5.21 OND-86 expediency of performance of these calculations is defined. Only those emissions of polluting substances for which the following conditions are satisfied pay off

М / ПДК.мр > Ф,

Ф = 0,01 x Н when Н > 10 m; Ф = 0,10 when Н ≤ 10 m;

М.мр	Sum of the emission from all sources	g/s
ПДК.мр	single maximum permissible concentration	mg/m^3
Н.вз = 2,0 м	average on height of sources of emissions	m

The results of the expediency of the calculations of the pollution substances diffuse at the near-the-ground layer are specified in the table.

Sunstance		ПДК.м.р. ОБРВ, mg/m^3	М g/s	М / ПДК -	Н г	Ф г	Expediency
301	nitrogen dioxide	0,2	1,385632*	6,928	2	0,1	Yes
337	carbon monoxide	5,000	1,315536	0,265	2	0,1	Yes
2754	hydrocarbons	1,000	0,38250053	0,383	2	0,1	Yes
123	ferric oxide	0,400	0,068738	0,172	2	0,1	Yes
143	manganous oxide	0,010	0,006168	0,617	2	0,1	Yes
323	silicon oxide	0,020	0,001564	0,078	2	0,1	No
10265	emulsoid	0,050	0,000025	0,001	2	0,1	No
328	Carbon black	0,150	0,066666	0,444	2	0,1	Yes
342	Hydrogen fluoric	0,020	0,000282	0,001	2	0,1	No
343	Fluorides well soluble	0,030	0,000879	0,029	2	0,1	No
2909	Dust inorganic 70-20%	0,500	0,64304	1,286	2	0,1	Yes
203	chrome oxide	0,0015	0,000042	0,028	2	0,1	No
10226	titanium oxide	0,500	0,001349	0,003	2	0,1	No
101	aluminium oxide	0,010	0,001092	0,109	2	0,1	Yes
10431	Metal duct	0,400	0,028	0,07	2	0,1	No
2404	Pairs of gasoline	5,000	0,0026529	0,001	2	0,1	No

Note: * emissions from processing equipment and motor transport taking into account work of 3 DES on a building site.

To carry out RZA in a ground sphere of atmospheric air:

- expediently - dioxide of nitrogen, carbon of oxide, hydrocarbon, iron of oxide, manganese of oxide, soot, dust inorganic, oxide aluminum.
- it is inexpedient – oxide silicon, emulsoid, hydrogen fluoric, fluorides well soluble, chrome of oxide, the titan of oxide, a dust metal, паров gasoline.

Air pollution charts (taking into account work of 3 DES) in a zone of building sites are provided in additions.

Table

Pollution levels on the construction site in ПДК,мр

Substance		ПДК.м.р. ОБРВ, mg/m^3	М, g/s	ПДК.мр
101	aluminium oxide	0,010	0,001092	0,04
123	ferric oxide	0,400	0,068738	0,25

143	manganous oxide	0,010	0,006168	0,83
203	chrome oxide	0,0015	0,000042	0,03
301	nitrogen dioxide	0,2	1,385632*	0,31/ 1,26*
323	silicon oxide	0,020	0,001564	0,19
328	Carbon black	0,150	0,066666	0,08
337	carbon monoxide	5,000	1,315536	0,40
342	Hydrogen fluoric	0,020	0,000282	0,02
343	Fluorides well soluble	0,030	0,000879	0,05
2404	Pairs of gasoline	5,000	0,0026529	0,02
2754	hydrocarbons	1,000	0,38250053	0,78
2909	Dust inorganic 70-20%	0,500	0,64304	3,30**
10226	titanium oxide	0,500	0,001349	0,01
10265	Emulsoid	0,050	0,000025	0,01
10431	Dust metal	0,400	0,028	0,29

Notes:
* emissions and pollution levels in Pdk.Mr from processing equipment and motor transport taking into account work of 3 DES on a building site.
** emissions to an inorganic building site on border don't exceed a dust 0,05ПДК.мр.

Level of pollution decrease in zavisimoyaniye from distance from a source to border of a building site

In a building site zone the greatest contribution to pollution of the territory gives nitrogen dioxide – 1,26 ПДК.мр.NO2 and a dust inorganic – 3,30 Pdk.Mr.

Actions of protection of the air environment from pollution

Actions for reduction of negative influence of nitrogen of NO2 dioxide in a building site zone:
1. It is necessary to increase, whenever possible, a ratio "length/width" of a building site (at the same area) that allows to reduce concentration of pollutants on the lateral faces turned to a housing estate on 20... 80 %.
2. Powerful cars and mechanisms which are sources of emissions of NO2, it is necessary to place as it is possible further from a housing estate.
3. In a working zone Pdk.Rz NO2 = 2,0 mg/m3 = 23,5 ПДК.мр.NO2 for the population. Therefore temporary value 1,26 ПДК.мр.NO2 = 0,13 ПДК.рз.NO2 can't cause substantial negative effects neither in workers, nor at the population.

Assessment of efficiency of actions

Actions are effective, as at construction on building site border excess of sanitary standards are absent on all components of influence.

3.1.4 Protection of the GROUND WATERS during the construction

Water supply.

East portal

1) Consumption of water on production needs of q1 = 8,2 p/a (30M3/hour)
2) Consumption of water on hozbytovy needs of q2 = 0,65 p/a (2,3M3/hour)
3) Consumption of water on a firefighting
- in the tunnel (on 1 fire) 10 p/a
- external on a building site of 10 p/a

- inside the premises $\frac{АБК - 2{,}5л/с}{Столовая - 2{,}5л/с} \rightarrow 5л/с$

q_3 = 25 л/с (90м3/час)

West portal

1) Consumption of water on production needs of q1 = 2,24 p/a (8,1M3/hour)
2) Expense on a firefighting
- in the tunnel (on 1 fire) 10 p/a
- external on a building site of 10 p/a

q2 = 20 p/a (72M3/hour)

Water disposal during the execution of works.

The section is developed according to PCO and meets the requirements of "Safety rule at construction of undergrounds and underground constructions" Moscow 1994.

During the calotte excavation the water disposal from the face to the purification facilities located at the construction site of the East portal is made by the water disposal pipe line □108x4,5mm using the pump ЦНС 60-132.

During the excavation of the lower bench the water from the preportal area is pumped by the pump ГНОМ 40-25 to the upper bench and is disposed by the self-flow into the purification facilities located at the construction site of the West portal.

The maximum expected water inflow during the tunnel excavation is specified on the basis of the engineering and geological surveys and makes 40$m^{3/}$hour.

Water supply during the execution of works.

The project provides laying of a fire and technological water supply system from pipes of steel ГОСТ 10704-91 Ø133x4,0мм for ensuring execution works and a tunnel firefighting.

Water supply sources at a driving of the tunnel are engineering networks of the East construction site. At portal the pump stations for pressure increase in a network for fire extinguishing are provided.

Diameter of the pipeline is defined taking into account the water admission not less 60M3/hour.

Firefighting in the tunnel is made by two streams, from calculation of a consumption of water on each stream-5,0 of p/a.

The crane the firefighter of Øу65мм (coupled) to heads GTs-70 is established on the fire-prevention pipeline at a portal and further through 50м, and also with its obligatory installation in a face (not further 30м).

Fire trunks and fire hoses should be stored in the special boxes established at fire hydrants.

With a step 50м operational Øу25мм gates with unions are established.

As a reserve for fire-prevention water supply are provided the winding of the fire-prevention pipeline with the pipeline of the compressed air, taking into account installation of additional fittings through 400м.

Surface of pipelines and fittings to cover with anticorrosive paint VD-AK-1FA of ТУ 2316-001-34895698-96 for 2 times.

MEASURES for the prevention and the decrease of the impact on the environment

Water supply of a building site causes formations of an economic and household drain. For a temporary economic and household drain from a building site the project of the organization of works provided devices of septic tanks which have no negative influence on environment.

Concentration of the weighed substances in rain waters is accepted 2500,0 mg/l. The project provided installation of 5 clearing constructions of rain drains of the capacity 100 p/a (in the territory of a building site of East portal – 3 units, in the territory of a building site of the Western portal – 2 units), with further dumping of the cleared waters in existing streams according to river Oporets and the river Vecha.

For branch of the river Vecha on the Western portal over the timbering of a retaining wall the rapid flow (the monolithic reinforced concrete course) is provided. For river Vecha dumping on the lowered marks the monolithic gutter is provided. Also the well is designed for dumping of drainage water from existing штольни on the Western portal (around crossing штольни and a retaining wall of a portal). For branch of streams and the river Vecha admission under tracks use of modular square reinforced-concrete pipes is provided. For branch of an atmospheric precipitation and drainage waters from the upland party of retaining walls and on a building site the system of monolithic reinforced-concrete drainage trays with water dumping in monolithic wells is provided. Water is dumped in the closed part of the bed of the river Vecha which will be constructed for construction.

For collecting and assignment of an atmospheric precipitation from a front slope of the Western portal the project provided monolithic reinforced concrete tray by section 300x300 (h) with water dumping in existing штольню and further in drainage a tray located along projected Ry.

For branch of existing streams on East portal the project provided the closed system of pipes and wells. Lengthening of drainage pipes are accepted from the reinforced concrete blocks in the size 1250Õ1500 (h) and 2000x2000 (h). Water is dumped in an existing waterway.

For collecting and assignment of an atmospheric precipitation from a front slope of East portal the project provided monolithic reinforced concrete tray by section 300x300 (h) with water dumping in an existing waterway.

Calculation of rain waters is executed in compliance Construction Norms and Regulations of 2.04.03-85 items 2.11-2.18. Proceeding from a settlement consumption of rain waters the section of drainage trays is picked up. Settlement filling and speed in trays correspond Construction Norms and Regulations. The section of water throughput pipes on East and Western portals is accepted on the basis of hydrological data according to the specification of the Customer.

3.1.5 Protection of the UNDERGROUND WATERS during the construction

By the project it is provided installation of the advancing and holding constructions against landslide provided with organized drainage and storm systems for interception of surface and underground water, arriving in borders of the territory mastered by construction.

In the existing tunnel sites which occurs the drainage waters are noted. These sites are observed on 410, 630, 910 m and in the range of 1320-1770 m from east portal that confirms data that waters are dated for cracks of radical breeds.

Possible water inflow to the tunnel proves to be true also results of the previous skilled forcings in a well 03b. The maximum inflow of water according to calculations made 4800 l/hours in a range of depths 65,2 to 69,0 m (absolute marks of 770,74-774,54 m), and in the range of 0,0-73,0 m – 6200 l/hours (absolute marks 766,74 – 839,74 m).

For branch of an atmospheric precipitation and drainage waters from the upland party of retaining walls and on a building site the system of monolithic reinforced-concrete drainage trays is provided. For branch of streams and the river Vecha use of modular square reinforced-concrete pipes with water dumping in monolithic wells is provided. And also monolithic reinforced-concrete rapid flows and gutters.

For branch of possible leakages of ground waters, condensate moisture, an atmospheric precipitation (on portal sites), and also waters from a firefighting – in tunnel lining in the channel under a ballast crushed stone layer installation of the punched polyethylene pipes with the geotextile filter is provided. For dumping of water and possibility of repair of the drainage – on length of the tunnel with a step of 40 m wells with a settling part are provided. To similarly underlining drainage – water is taken away from the East to the west, and on the Western portal is dumped in a water reception well.

Zones of influences are in borders of the land lot. By criterion of influence on underground waters the sanitary and protective zone (gap) isn't necessary.

The filtration drains are admissible.

3.1.6 Protection of the SOILS during the construction
Earthwork has the main influence on a condition of soil.

At a construction of tunnels of big sections motor transport is applied to an fill of breed: from the tunnel to an overload on the Western portal and to a dump on East portal and deliveries of materials in the tunnel use of a road train of MOAZ 74051-9586 with duplicating governing bodies is provided. All cars with the diesel engines, working in underground conditions are supplied with converters of exhaust gases. On an overload of the Western portal the developed breed is overloaded with the excavator in dump trucks and transported on a dump.

For a dump of soil sites are taken away:

- On the Western portal, it agrees the «The project of the transfer of the land lot to the STEA "Lvov railway» for the construction and arrangement of the Beskyd tunnel outside the boundaries of the Skotarskoe village council of Volovetsk District of Zakarpatye Region" of the total area - 2,1he;

- On East portal, it agrees «The project of the transfer of the land lot to the STEA "Lvov railway» for the construction and arrangement of the Beskyd tunnel outside the boundaries of Oporets village council of Skolivskoe District of Lvov Region» with the total area - 2,5 he.

The Dump banks are at the distance:

East portal – 800 m from a portal;

The western portal – 2000 m from a portal.

For delivery of the developed soil at a tunnel driving the project provides construction of highways with modular reinforced concrete covering.

Works on the device of highways the project provides during the preparatory period.

The main works on arrangement of dumps are made in process of a tunnel driving.

The design volume of dumps of soil makes:

On East portal – 172,1 thousand m3 of soil; on the Western portal – 42,8 thousand m3 of soil.

Works on отсыпке soil on East portal is provided to make in 2 stages:

1 stage:

- the backfill of the soil is made to a mark 775,0. Delivery of soil to a dump is carried out by tunnel dump trucks of MOAZ on an access road from a building site, with its gradual elimination. Road plates are dismantled by the crane, taken out and stored in the building site territory.
- the backfill is made by the bulldozer (capacity of 240 h.p.) with soil consolidation by skating rinks on pneumotyres (weight 25т) layers of 0,25m. Factor of consolidation 0,95. Planning of the slopes is made by the excavator the scheduler.
- bosoms behind the gabions are filled up with sandy soil layers 0,25м. Soil consolidation in the constrained conditions is made by small-sized mechanisms. Factor of consolidation 0,95.

2 stage:

- the backfill of the soil it is made from a mark 775,0 to a mark 785,0. Delivery of soil to a dump is carried out by tunnel dump trucks of MOAZ.

- during the measuring of the backfill and raising of the horizon of works, road building with use of the plates dismantled at the first stage is carried out.

- the backfill is made by the bulldozer (capacity of 240 h.p.) with soil consolidation by pneumatic rollers (weight 25т) with the layers of 0,25m. Factor of consolidation 0,95. Planning of slopes is made by the excavator.

Works on the backfill on the Western portal is provided to make in the following sequence:

The soil developed at a driving of the tunnel, is delivered by dump trucks loading capacity 20т, to the dump territory, is unloaded, moves the bulldozer (capacity of 240 h.p.), are leveled by layers of 0,25 m and condensed with pneumatic rollers (weight 25т), at a driving of 16 times on one trace. Factor of consolidation 0,95. Planning of slopes is made by the excavator the scheduler.

Bosoms behind the gabions are filled up with sandy soil layers 0,25м. Soil consolidation in the constrained conditions is made by small-sized mechanisms.

Prior to the beginning of the construction works for the construction of a gabion protecting wall the following works must be made:

- branch of a surface water from a platform is organized;
- access roads are arranged;
- ways of movement of mechanisms, places of warehousing of a stone and gabion designs are designated, the assembly equipment and adaptations is prepared;
- gabion designs, geotextile and stone in necessary quantity are delivered;
- geodetic breakdown of axes according to the project is made.

Works on a construction of the gabion protecting wall include such technological operations:

- development of soil under the gabion protecting wall;
- geotextiles laying (density of 250 g/sq.m);
- the basis device from the mattresses (Renau mattresses);
- construction of the 2nd and the subsequent ranks of a gabion protecting wall;

Works on a construction of the gabion protecting wall is provided to make in the following sequence:

1 stage of works:

Device of the temporary road for work of construction equipment and stone warehousing. Development of a trench by the excavator, under the device of a protecting wall from габионов is made. Planning of a bottom of a trench under the device of a protecting wall is made. Laying of the first layer габионов begins with sites with the most lowered marks on all perimeter of a site of building, but taking into account the free spaces provided for the device of temporary roads, warehousing of materials, and also the technological spaces necessary for operation of cars and mechanisms. The geotextile is covered on all area of internal installation of gabion constructions. The first row of a protecting wall from габионов is formed by gabion mattresses of Renault of factory production. Their assembly and installation is made. Mattresses of Renault should be properly created and established, according to the instruction of assembly of gabion designs. The sheaf with already filled and earlier established mattresses of Renault is made. Filling of mattresses of Renault with a stone (M 600 and above) manually is carried out. Giving and stone loading in a body габиона is possible for organizing in the mechanized way with the subsequent its formation manually directly in габионе. The quantity of a stone in filled габионе should exceed the top borders габиона on 3-5 see. After leveling of a stone the cover by means of a knitting wire becomes attached.

2 stage of works:

The second and each subsequent number of the gabion protecting wall is formed of the prefabricated gabion boxes. Their assembly and installation is made. Boxes should be properly created and established to gabions, according to the instruction of assembly of the gabion constructions. The sheaf with already filled and earlier established gabion boxes is made. Filling of the gabion boxes with the quarry stone (M 600 and above) manually is carried out. For once fill only a half of the gabion box in the size, and then gabion is fixed in the middle of a horizontal sheaf over a stone layer then fill the second half of the gabion box. The gabion boxes are connected among themselves, forming the gabion construction. The covers of the gabions are necessary for drawing densely to forward sides and at the same time to tie with a wire.

Dump banks

	Name	Designed capacity	Notes
1	West portal:		
	-dump bank at the area of ПК20-ПК22	21311 м^3	3702,98 m^3
2	East portal	241769м^3	24473,34 m^3
	Total:	263080 м^3	
3	West portal. Construction site		
	-area	3800 m^2	
	- excavation ground	14663,8 m^3	

Estimated indicators are distributed on the territory in borders of the land lot.

Zones of influences are in borders of the land lot. By criterion of influence on soil the sanitary and protective zone (gap) isn't necessary.

3.2 COMPLEX ANALYSIS of the CONSTRUCION SITE

Requirements to construction infrastructure

Placements of access roads and motor transport parking, hoisting-and-transport mechanisms, a stroyoborudovaniye, electrodevices, tools, engineering arrangements household and warehouse it is provided according to the project of the organization of construction (PCO). Household placements on time of construction are equipped with septic tanks.

For ensuring public catering of the working points of hot meals are expediently organized. Quantity of the working – 69 people. Therefore calculation of a household waste is made, as for catering establishment: a dining room without selection of a food waste. Daily average norm of formation of TBO on 1 place - 0,5 kg. Therefore the quantity of educated TBO per day makes: 0,5 kg x 60 people = 30 kg/days. In the territory of a building site container placement for TBO is provided. A construction waste which aren't subject вывозке on TBO range (candle ends of electrodes, etc.) will gather to the corresponding container. In process of accumulation, all TBO will be taken out on utilization on the enterprises, with which the Customer or the General contractor will make contracts on utilization of such waste.

Requirements to export or utilization of the construction waste

- Export of the construction waste is provided by the organization the construction works, places of their warehousing are in accordance with the established procedure coordinated.
- Export of the construction wastes is carried out according to Management limits of the ecological elements.

Requirements of the restoration of lands after the construction works are finished

The sites which have been taken away under dumps are located on existing slopes with a bias between 25 ˚ and 40 ˚.

At the device of dumps of soil the project provided protection against washout by rain waters by fastening (protection) of dumps by gabion retaining walls. Thanks to porous structure of the gabions high permeability of the gabion constructions for water and air is reached. Characteristics of the gabions provide their constructive integrity, durability, permeability and environmental friendliness.

Over time gabion constructions merge with environment and become a part of a natural landscape.

By the project it is provided the cut of the vegetative layer, for the subsequent restoration. The technical and biological restoration of lands after end of the construction activity is carried out according to the project of an accomplishment and the gardening sheet.

Requirements to a choice of the optimum technological decisions reducing negative influence of construction on OS

By production of construction works actions from an adverse effect on environment are provided:

- parking of construction cars it is designed with a firm covering;
- on departure from a building site the wash of tires of cars is provided;
- purification of rain waters on treatment facilities is provided;
- utilization of the chosen soil with the device of dumps of soil;
- utilization of a firm household waste and a waste from the technological processes (electrodes, the remains of fittings, concrete etc.);

3.3 COMPLEX EVALUATION of the CONSTRUCTION

Influences on natural objects – the design site is generally covered with the wood, with a grass-covered surface, on east slope the coniferous – a fir-tree and a fir, and on the western slope deciduous – a beech. It is possible to find small haying grounds and meadows in the woods. According to the technological task STEA «Lvov railway» the project provides the device round portals of roundabout

paths (on abrupt sites – ladders). In the protected territory buildings of protection and a construction of a special purpose are placed. On perimeter the protection and precautionary signs is established.

Influences on the environment of activity of the person – minimum also answer sanitary standards. Influences on surrounding buildings and constructions – are absent.

COMPLEX MEASURES for the creation of the comfortable conditions for the society living at the construction area:

- measures for the decrease of noise at the construction site. The sources of noise at the construction site are the compressor station, vehicles.

In order to decrease the noise influence the following measures are provided:

- fences of the construction site;
- assembly of the quality road surface at the construction site;
- compressors in the noise-protective execution;
- withdrawal of the construction wastes;
- collection and purification of the rain waters at the local cleaning facilities (3 units at the East portal and 2 units at the West portal) from the territory of the construction site;
- technological and biological restoration of the soil;
- landscaping;
- territory accomplishment..

Justifications of an admissibility of residual influences – residual influences from construction are in limits of norms and additional justification is not requested.

4.1 Evaluation of impact on the environment during the LIQUIDATION of the designed object

Liquidation of the projected object isn't provided. The normal operational state is provided to support at the expense of routine maintenance and overhaul repairs.

Influence on environment at elimination of object doesn't differ on structure and scale from influence at construction. The irrigation of the construction designs which dismantle is connected with dust emissions is an additional condition.

APPENDIXES

Printout from the program “ЭОЛ”

Copies of the Orders, letters, ТУ.

General layout, dendrological plan